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ORIGINAL COMMUNICATIONS.

"A body of men engaged in the same pursuit, form a joint stock of their information and experience, and thereby put every individual in possession of the sum total acquired by them all."—REV. DR. WILLIAM CAREY.

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THE JOURNAL

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OF

INDIA

Suggestions for the treatment of Foreign Vegetable and Flower Seeds. By Mr. Robert Ross, *Head Gardener, H. C. Botanic Garden, Calcutta.*

To James Hume, Esq. *Honorary Secretary of the Horticultural Society of India.*

Sir,—A few suggestions on the treatment of English, Cape, or American Vegetable and Flower Seeds, and the season at which they should arrive in India, so as to give them at least a chance of coming to maturity before the hot months set in, may be acceptable to those who take a pleasure in the cultivation of exotic Flowers or Vegetables, as there can be no doubt, but that there is room for improvement in this matter; perhaps it may be said with truth, that the foundation has not yet been securely laid, so as to insure the object which the Horticultural Society of India, and others, have been so long striving to establish. It may not be generally known or considered abroad, that our cold weather Vegetable and Flower Seeds, almost always arrive in India at too advanced a season, and unless this evil is pointed out to those who send the

seeds out, how are they to know. No doubt, some old experienced Indian at home, or here, may have pointed it out long since, but not urged it to that extent the case demands, or if they have done so, the thing has not been attended to as it ought, and until it is, there must necessarily be a blank in the vegetable products of India, as far as vegetables, &c. from colder climes are intended to form a part of its produce.

Para. 2nd.—I often hear complaints of the inferiority of Imported Vegetable and Flower Seeds; this appears to be an annual grievance with some one, or another. It may be so, but I am inclined to think, that the fault lies more frequently in the treatment the seeds receive, than in the seeds themselves. Few perhaps, in this part of India, sow a greater yearly variety of seeds from all quarters than I do: and the Superintendent, Doctor Wallich, has a regular supply of the seeds, annually sent out from home to the Horticultural Society. Although we have not time to attend to the cultivation of vegetables to any considerable extent, yet a portion of each species of seed received from the Society is regularly sown, for the purpose of testing its vitality, before the Superintendent sends it to his friends, or gives it to applicants. The dates when the seeds are sown, are regularly entered in a book for the purpose, and also the dates when they germinate, are regularly entered in the same book, and it does not appear from this record, which has been kept regularly for so many years, that Vegetable and Flower Seeds thus received may be considered bad, but on the contrary.

Para. 3rd.—Relative to the seeds we are in the habit of sowing from day to day, we are careful, in the first place, in preparing suitable mould, that is, mould that will not cake or become hard by frequent waterings, which would much retard the germination of the seeds, if not quite kill them. It consists in an equal proportion of vegetable mould, or the mould made from decayed leaves, and common garden mould, or virgin earth, when it can be procured, added to which, about

an eighth part of river sand. This compost is made as friable as possible, so as to afford no inequality of resistance to the roots of the young plants as they descend. The mould for covering the seeds is carefully sifted, so as to afford no resistance to the seed lobes or cotyledons, as they are raised out of the ground by the ascending stem. Large pots, gumlahs, or boxes, are then prepared, by being washed as clean as possible. I may here observe, that washing the pots, gumlahs, or boxes quite clean, that have been in use before, is most essential to the health of plants, young or old; experience has long taught me this, although some may not think it necessary, but may content themselves with simply shaking the old mould out of the pot, or box, and putting in fresh. Plants, like to be treated with kindness, as well as man, or any other animal; filth, or dirt, does not suit them, although they may sometimes like to feed on it a little, but not to be exactly planted in it; and up to this date I have had more trouble to get the malees, and those under them, to wash old pots, &c. in which fresh plants, or seeds, are intended to be placed, than I have to get them to perform any other duty, for they cannot see the necessity of washing clean a pot, &c. that is going to be made dirty so soon after.

Para. 4th.—Having the pots and mould thus prepared for the reception of the intended seeds, observe, before putting the mould into the pots, &c., to place over the hole, or holes, at the bottom of each, some pieces of tile, potsherds, or gravel; this is done both to prevent the holes from being clogged with earth, and the earth from being washed out with occasional waterings; and it is also intended to prevent the roots of the plants from getting out, should any of the seedlings be allowed to remain in the pots so long as to have time to form roots so large as to make their way through the holes at the bottom of each pot: this done, fill each pot with earth to within about half an inch of the top, pressing the mould gently and equally into the pot at the same time, and making it as even

and level as possible at the top: then sow the seeds, but take care not to sow them too thickly, for if sown too thickly, the one will draw the other up sickly, and weakly. Having sown the seeds in this way, cover them over with the mould sifted for the purpose, but take care that they get no more than just enough to cover them: if the seeds are large, the operation is easy, but if they are very small, it will be best to sift a little fine sand over them, as it is hardly possible to cover them properly, with even the siftened mould, except by an experienced hand; choice and select flower seeds are here meant. I am thus minute in pointing out how seeds sown in pots should be treated, because their germinating depends so much on their being properly sown. This paper is not meant or intended, to teach those who understand all about the matter, but is meant to instruct native gardeners more particularly; and I think papers of this nature should be circulated as largely as possible amongst them, in their own language, so that they might read and understand, for many of this class are not without the gift of reason, or common sense.

Para. 5th.—Having sown the seeds, in the way I have endeavoured to describe, and given them a little water afterwards from a hand syringe, or the fine rose of a watering-pot, they are to be placed under cover, that is to say, in a place where they will not be exposed to the noon-day sun or to heavy rains, and there to remain until the seeds have germinated (taking care to keep the mould about the seeds damp, but not wet) and the plants have got a leaf or two above the seed leaves or cotyledons, when they may be placed outside, mornings and evenings, for a few days, and then after having become hardened by exposure, finally placed outside.

Para. 6th.—When the plants are about two or three inches high, or have got four or five leaves above the seed leaves, they are to be potted off early in the morning or late in the evening, watering freely after potting, to settle the mould around the roots, (if there is no danger of heavy rain, it will

be best to let them remain outside all night,) and then place them under cover again from the hot sun for a few days, until they recover the shift, when they may be finally placed outside; but on no account should young or old plants be allowed to remain under the shade of trees, it is sure to destroy them or make them sickly; in such a situation, they are drawn up sickly and weakly, and when finally placed or planted out, where they are meant to stand, in an exposed situation, the change is more than they can bear; I mean the sudden change from comparative darkness to light, and the great heat of the sun acting on the leaves and tender shoots that have been so long shaded.

Para. 7th.—If early Cabbage, Cauliflowers, or Broccoli plants, &c. are intended to be raised in pots in the way I have pointed out, and for early crops, I think they should be raised in th way as they can then be turned out of the pots into the open ground, where they are meant to stand, with the ball of earth entire, and so would not be subjected to any check in their growth by transplantation. The mould for them must be rich and good; vegetable mould will not be rich enough for them, although it suits flowers best; instead, therefore, of using the compost I have named, add to it one-fourth part of well-rotted cow manure. (See the 11th para. of a paper, in the third volume of the Society's Journal, where cow manure is mentioned: this is just the sort that is wanted for the vegetable seeds referred to above.)

Para. 8th.—I have so far endeavoured to detail the best practice, as followed here, with seeds sown in pots, namely, the treatment required until the plants are large enough to be turned out of the pots into the open ground, whether they are flowers, or some sorts of vegetables (see para. 7th of this paper) that must be sown in the midst of the rains, and nursed in this way, so as to have good, healthy plants to turn out into the open ground, previously prepared to receive them at the breaking up of the rains. But the question may now be put,

how are we to carry these practical suggestions out into the open ground or field? This I shall endeavour to explain as we proceed, and also to show, that many plants and seeds are lost; through the treatment they receive, and not from the effects of the climate. With respect to the vegetables that may be raised in pots and nursed in the way described, it will add to their well-being, if the pots which contain them, are plunged into a bed so deep as just to cover them; I mean a bed like that I shall endeavour to describe hereafter, intended for raising salads of various sorts. By plunging the plants in pots in a moist bed in this way, the roots would not be subjected to such sudden change of atmosphere, as they would be if kept exposed; consequently, they would thrive much better.

Para. 9th.—The practice of watering Vegetable or Flower Seeds, that have been sown in beds or pieces of ground, by surface irrigation, is highly injurious; more particularly for small seeds. It is in every way calculated to destroy the seeds, it washes them too deep into the ground to allow them to germinate, or if they should escape being buried too deep, they are liable to rot from too much moisture, because the quantity of water given, cannot be ascertained. Seeds require no more moisture than is sufficient to keep them moderately moist, so as to excite germination, and as the radicles descend in search of food for the plant, or for whatever cause—whether in search of food, or to fix the plant firmly in the ground, I know not,—perhaps for both,—the water should be increased in proportion. On the other hand, if seeds do not get enough water, they will die for want of moisture. The quantity applied to plants or seeds, is not a matter of indifference. Plants will not live without water, nor will they prosper where it is too abundant,—aquatic plants excepted.

Para. 10th.—I was in a garden not long since, where I saw a piece of ground laid out in beds about four feet wide, and cropped with English and Cape Vegetable and Flower Seeds; the ground was so soft with surface irrigation, that it was im-

possible to walk on it without sinking in it several inches; few plants were to be seen in any of the beds, although the seeds seemed to have been in the ground long enough for all to have been up several inches. It is impossible for Vegetable and Flower Seeds to germinate freely in a hot climate, and in a soil so inundated as this was; it is just the way to kill them: many seeds are destroyed in this way, and the cultivator probably lays his want of success on the badness of the seed, when such in reality is not the case.

Para. 11th.—The reason why I condemn surface irrigation for grounds under the culture of Vegetables or Annual plants is this,—every time the seeds are watered, the water in passing through the channels to the beds, forces with it, less or more mould from the sides or bottom of the channels, and deposits it on the seeds, as it flows on the beds. The mould thus conveyed on the beds, becomes considerable in a short time, and buries small seeds too deep, to allow of their germinating. Vegetable, or indeed any small seeds, do not require to be covered with mould after sowing, to insure success; it is not natural to them, and they will do as well, or better, without, provided they are protected by shading and kept sufficiently moist, until they have germinated, and the radicles have got properly established in the ground. As a proof, that covering seeds after sowing is not absolutely necessary, I may simply say, that thousands of self-sown seedlings may be found every year in the jungle, or in gardens, from the largest seeds, such as the mango, down to the most minute. In teak plantations, young self-sown seedlings are to be had in great plenty every year, and yet if this seed is collected by hand and sown in beds and covered with mould, in the usual way, not one in twenty will germinate. There are a few exceptions indeed to this, the sissoo (Dalbergia Sissoo) a forest tree, equal in size to the teak, will not propagate its species from self-sown seeds, unless it happens to fall from the tree on cultivated ground, close to the tree that produced the seed, or is driven by

the wind or other causes from the tree that produced the seed to cultivated ground, or ground under cultivation at a distance from the tree. Doctor Wallich, the Superintendent of this garden, was the first, and the only person, I ever heard mention this fact some years ago, and since that time, I have carefully paid attention to the subject, and have never been able to find a self-sown sissoo seedling. The young plants usually seen round sissoo trees, are nothing more than suckers from the roots, and if any one doubts this, if they will take the trouble to try or examine, they will find, what is here stated, to be correct.

Para. 12th.—I do not altogether condemn surface irrigation, but for grounds under the culture of Vegetables or Annual plants, subterraneous irrigation would, I think, answer better, and the seed would be less liable to perish or rot with too much moisture. I suppose the seed to be sown in beds four feet wide, with an alley or space between each, two feet wide for the water channels, and to walk upon when weeding the crops, &c. For surface irrigation, the beds must necessarily be lower than the alleys or channels from which the water is to be conveyed on the beds; instead of the surface of the beds being below the natural surface of the ground, they should be raised a little above the surface, say, one or two inches, and the channels between the beds should be excavated about eight inches deep, and as many wide, and filled with water, when it may be thought necessary; this mode would effectually irrigate the sub-soil, and a very little surface water from the fine rose of a watering pot, or garden engine, would be sufficient to keep the surface moderately moist, to cause the seeds to germinate; and there would be no danger of the seeds being over-watered, with proper management.

Para. 13th.—The preparation of ground for vegetables, by digging, trenching, and manuring, should be performed in the hot months. It is wrong to delay doing this until immediately before the season of sowing or planting, as the ground

then generally gets such a superficial preparation in the hurry to get in the crop, that plants can derive but little benefit from the operation. In many instances I see it done when the seeds or plants should have been in the ground several weeks, so that so much of the most favourable season for raising vegetables is lost, or at least not improved to that extent it might be; as there can be no doubt that exotic vegetables or salads can be raised here, if not in all, at least in most months of the year, with the same treatment and care in preparing, and manuring the ground for them, that they get at home. And why is it that more of them are not raised, at what may be termed an unfavourable season? The reason appears to me to be simply this,—there is too much left to native agency, even where the thing might be done more complete, as there can be no doubt, but that there are hundreds of European gentlemen in India, who know how these things should be attended to, to insure succcss, but from some cause or other, they leave it to be superintended in whole, or in part, by the native overseers or malees they employ, and rest satisfied with simply telling them how things are to be done, without seeing that it is done properly. There is not a native overseer or malee in India that will do a thing as you tell him, unless you stand over him, and watch his every movement; at least not out of the two hundred we have in this garden; and I doubt not, there are many such in other quarters.

Para. 14th.—The proper season to manure garden-ground in this climate, or indeed for any crop that requires manuring, is just before the commencement of the rains, say the latter end of May or the beginning of June. The ground should, in the first place, be prepared for the manure, either by digging it one foot deep, or trenching it two feet deep, if trenching is intended; and for ground that has been long under crop, trenching would be of much service, as it would be giving the ground a fresh surface, an object that is not enough attended to; the good effects of which are, as far as I can learn, but little

known in this part of India. Trenching is carried on in this garden to a considerable extent with success, so that I speak with confidence, and would urge its adoption in all quarters. In trenching, all that is necessary, is to open at one side of the plot a trench of the desired depth, three or four feet broad, and the whole length of the piece intended to be trenched; then proceed to fill this opening from one end by working out a simliar one. In this way proceed across the plot to be trenched, and then return, and so on, in parallel courses, to the end of the plot, observing as you go on, that the old surface soil is always placed at the bottom of each trench, and the bottom placed on the top, so that when the plot is finished, it will have a fresh surface.

Para. 15th.—When the ground for vegetables has been made level, after having been dug or trenched, the manure should be spread over it, and then dug in, just so deep, as barely to cover it with mould. The object of covering the manure with mould so slightly at first, is, that the solid matters contained in it, capable of being dissolved by water, may be washed into the ground, so as to enrich it, by the heavy rains so shortly expected, and when the ground is meant to be sown, or planted. At tbe breaking up of the rains, all that is necessary, is simply to dig it afresh, breaking it as fine as possible. After digging, mark out the beds, &c. and sow or plant, which ever is intended. After sowing, tread in the seeds lightly all over the beds, and rake in the seeds regularly lengthwise into the beds, so that little time is lost at the season tbe plants or seeds should be in the ground and may be expected to thrive. If ground is manured at the breaking up of the rains, it remains with very little alteration in tbe same state, as when it was turned into the ground, until tbe succeeding rains, or wet months, so that the plants derive but little nourishment from it, and the object of manuring the ground for the benefit of the crop is frustrated. And how can it be expected to be otherwise, when perhaps the manure is applied in a very dry

state, at a very dry season, or the commencement of the dry season, and in a very hot climate? The more moisture the manure has in it, the better. I consider manure applied in a dry state and in a dry season, in this climate, to be of very little use to vegetables of any kind, hence the preserving manure for any length of time until it is wanted, is of importance. It should, if possible, be defended from the sun. To preserve it under cover, would be of great use, or to make the site of a dung-mixing on the north side of a wall or plantation, and not allow any of the fluid that may collect in it to be lost, as it may be considered the best of the manure for any purpose.

Para. 16th.—As the quantity of manure required for some sorts of vegetables is of importance,—for without it, good, large, show specimens cannot be produced,—it may be necessary to give some idea of how much should be given. Ground for cabbage or any Brassica requires to be very rich and well manured: the manure should be spread all over the ground two inches thick, if it is three inches deep, or more, all the better, it will not be too much. Onions should have the same quantity of manure, except they are meant for pickling, in that case, they should be planted or sown in a poor soil. This may appear an enormous coat of manure for any vegetable ground, and so it would be, was it the intention to cover the whole of the ground cropped with vegetables in this way, but this is not the case. The ground manured so one year, will not require manure for some years after, as it will come in for other crops that do not require such a rich soil. Such as, beans, peas, carrots, parsnips, and many others that would come in rotation. Ground for carrots, or parsnips, should not be manured the same year the seeds are to be sown; if it is, it should be very rotten, and have nothing in it calculated to obstruct the roots as they descend; but they would be much better in quality, were they raised in new ground, or ground that has not lately been turned up by the spade, or plough. Celery is another plant that requires a great

deal of manure to grow it to a large size; indeed, it should have the manure alone, without any mixture of earth, except just enough to cover it on the top from the hot sun, four, five, or six inches deep in the trenches, in which it is planted. But I fear it will be swelling this paper to too great a length to enter minutely into the treatment of many individual vegetables.

Para. 17th.—For raising salads of various sorts, such as lettuce, endive, radish, and any others, a very rich bed should be made, raising it about six or eight inches above the surface, and sinking it about six inches below the surface, so that the roots of the plants would have about twelve or fourteen inches of depth of rich ground to grow in, a depth sufficient for this sort of crop. For convenience in gathering or cutting the crop, or weeding, watering, &c. the beds should be made about four or five feet wide, and as long as may be thought necessary. Over the bed, a stage or frame should be made, about six or seven feet high, and the roof covered with mats, or any thing else that will answer to shade it from the hot sun, or heavy rains, and the sides left open; but observe, that the bed is to be shaded in this way only from a hot sun or heavy rains, at all other times it is to be exposed. On each side of the bed, and as close to it as possible, a trench should be dug about one foot deep, and about eighteen inches wide at the top, and filled with water, when it may be thought necessary; if this is attended to, with a little surface water, from the fine rose of a watering pot, or garden engine, the plants will thrive and do well, provided they are regularly thinned out, so as not to be allowed to touch each other; the roots will be sure to find out the moisture at the bottom, but care must be taken, that the water is not too abundant, or it will rot the roots when they come in contact with it, that is to say, when the roots are allowed to remain in a very wet soil for a considerable time. It is very easy to place pieces of wood or any thing over the drain to stand upon, when it is necessary to sow, weed, or water the bed. It is surprising to what a great

depth the roots of some plants will penetrate into the ground, when they are in a soil they like. The root of the pea, though so small, will penetrate two feet deep. In the bed just described, young plants that are being raised in pots might be plunged, and it would benefit them much; (see a former para. of this paper). I may further add, that a bed of this sort would answer admirably for early horn carrot, &c. As the mould of which the bed is supposed to be composed, would not keep in a perpendicular position at the sides, without support, turf from a pasture will answer very well, or any thing else that may be convenient, such as slabs or rough boards of any kind, to give it support.

Para. 18th.—A more suitable place or bed than that I have just endeavoured to describe for raising salads and vegetables of sorts, would be the north side of a wall. A wall sixteen feet high, built direct east and west, will give a border that the sun will not reach, eight or ten feet wide, or more, if not quite, at least, nearly one half the year, namely, from September to March, and the difference of temperature on the north side from that of the south is considerable. I have tried it in this garden, and find that it is no less than thirty degrees; indeed, in this present month, (November) from repeated trials at twelve o'clock, and at two P. M. I found the difference thirty-four degrees; I mean on a thermometer placed in the shade on the north side, and in the sun on the south side; and I find that plants that would not live if planted on the south side, will do well on the north side, that is to say, plants of exactly the same species, or propagated from the same plant. The wall referred to, is fourteen inches thick, but I do not believe that a wall only one brick thick (4 inches) would be so cool on the north side. A bed for exotic vegetables, flowers, or some sorts of fruits, (the latter could be trained on the wall,) is just what would answer, and could be made on the north side of a wall of this sort, and there would be no expence for shading for six months out of twelve. In the hot and wet month

when the sun is nearly vertical, and indeed quite so part of the time, there would be but little shade on the north side of the wall. If I remember correctly from observations I made last June, there would not be more shade at twelve o'clock than one foot, or eighteen inches, and up to about eleven o'clock there would be none, as the sun is then so far north. At such a season, the frame, stage, or shade for the bed referred to in a former para. of this paper, could be used, as vegetation is never at a stand in this climate, where moisture is to be found, and where water, one of the grand agents in the vegetable kingdom, can be administered judiciously. I think that many English, and Cape vegetables and salads can be produced here the whole of the year. Seeds will germinate in India at any season, and I think any private family may raise vegetables on a north border, in the way I have described, the whole of the year, at least enough for family use, and at a season when they might be considered a luxury.

Para. 19th.—The season at which Vegetable and Flower Seeds should arrive here, is early in July, when the sowing may commence; and for family use small sowings of vegetables and salads should be made every fortnight or three weeks; as a great many species so soon run to seed in this hot climate, it becomes necessary to sow frequently, so that a suitable supply may be at all seasons available; and for some sorts, such as spinage, it will be necessary to sow every week, and indeed at some seasons of the year, twice a week. Experience will soon point this out, so that I need not enumerate, my object being simply to note a few general suggestions throughout this paper. Flower seeds should be sown in small quantities in the same way, so that if any should fail through neglect or other causes, there would be a succession to fill up the blanks thus made. The reason why so few English, American, or Cape flower plants, as well as vegetables, come to maturity here, is chiefly because they are sown at too advanced a season, and placed in too exposed situations in the sun, and our

winters being so short, they are cut off by the hot, dry season, before they have time to come to maturity: whereas, were they sown in July or early in August, and at the breaking-up of the rains, turned out of the pots on a border in a north aspect, they would do well, as the sun could not reach them, if placed on a bed or border on the north side of a wall, until the latter end of March at least,—I mean the meridian sun, the most destructive to tender plants. The want of such a situation as this is the cause of so many failures, and I am surprised that a wall or screen of this sort (if it should be nothing more than bamboos and mats, which would be better than nothing,) has not been suggested or tried. It may have been tried, but I am not aware that its advantages have ever been brought to public notice. Let us give this suggestion a little more scope, and suppose several walls to be erected on, say one-fourth of an acre of square ground, the walls to be 14, 16 or 20 feet high, or more. What would the proprietor have for his trouble and expence? Why, he would have about one half of this space, more or less, that the sun would not reach, for six months out of twelve; and also the advantage of the north sides of the walls for exotic fruits, &c. and the beds or borders for the various vegetables, flowers, &c. he may think proper to cultivate, with much less trouble, than he would have, if the plants were placed in exposed situations. Bricks and labour are cheap enough, and a few thousand rupees to some gentlemen, laid out in the erection of walls, would be of little moment.

Para. 20th.—As the seeds that would be forwarded from England, America, or the Cape, so as to arrive here in July, would be the produce of the former season; and as objections might be raised against such seeds, lest they should not germinate after having been gathered, six or nine months before the date of their despatch to India; it may be necessary to give some idea of how long certain vegetable and other seeds

may with safety be kept, so as to ensure their germinating after sowing. The latest dates at which some seeds generally sent out to India, as well as some natives of India, may be expected to grow, are the following:—

Cabbage tribe—three years; they will grow after four.

Leguminous, culinary vegetables, comprehending the bean, pea, and kidney-bean—one year.

Esculent roots. Beet—nine or ten years; turnips and skirret—four years or more; carrot and parsnip—one year; radish—two years.

Spinaceous plants. Spinage—three years; orach—one year; purslane—two years.

Alliaceous plants; such as onions, leeks, &c.—two years.

Asparaginous plants. Asparagus, seakale, and artichoke—three years. Cardoon and rampion—two years.

Acetarious plants, or salads—generally two years; lettuce and endive—three years; burnet—five years; mustard and parragon—four years; sorrel—six years; celery—nine years, or more.

Pot herbs—generally two years; parsley, dill, fennel, and chervil—five years; marigold, and borage—three years.

Sweet herbs—generally two years; but rue and rosemary—three years; hyssop and thyme—five years.

Tart Plants, or plants used in tarts, &c.—generally two years; but rhubarb—only one; and gourds and pumpkins—ten years.

Herbaceous fruits.—The cucumber and melon—ten years. Indeed I have raised melons from seed thirteen years old, and I believe it would have kept fresh many years longer. Love-apples and capsicum tribe—two years.

Annual and biennial flower seeds—generally two years, but some only one.

Tree seeds, stones—two years; and some species of Cratægus (Haw)—three; but their success is doubtful the second year.

Coffee seeds will not germinate, unless they are sown within six or seven weeks after they are gathered. I give this hint here regarding Coffee, because I have often heard complaints about their not germinating.

The vitality of some of the seeds referred to above, I have tested at home, and some here. Seeds lose their vitality much sooner in India than in England; indeed, many Indian seeds require to be sown the moment they are ripe; some, I find, will not keep fresh for a single week.

Para. 21st.—An estimate of the quantity of some kinds of seeds, that are required to sow certain portions of ground, may be of use, as it will enable cultivators, who know little of the matter, to calculate how much seed they will require for the ground they intend sowing; so that they need not be at the expense of purchasing more than is necessary. With this view then, I shall commence with the Cabbage tribe:—

Cabbage Tribe.—For a seed-bed four feet wide by twenty-four feet in length, two ounces will be required. There are some sorts of the Cabbage tribe, that require a less proportion of seed for the same space of ground; but as this is of little importance, I need not enumerate them: my object is simply to give an idea of how much is necessary.

Leguminous Culinary Vegetables.—Beans. Plant all the sorts in rows, two feet apart for the smaller, and three feet apart for the larger sorts. For smaller sorts, one pint of seed will sow eighty feet of row: and one pint of the larger sorts will sow forty feet of row, from three to four inches distant in the row.—Peas. Sow all the sorts in drills from three to four feet asunder. Of the small early kinds, one pint will sow

a row of sixteen or twenty yards: for the larger sorts, the same measure will sow a row of thirty yards.—Kidney Bean. Sow in rows as above: half a pint will be enough for a row seventy feet in length; the beans being placed nearly three inches apart.

Esculent Roots.—Potatoe. For a plot of ground thirty-two feet wide by forty-eight feet in length, planted in rows two feet distant, by twelve inches in the row, two pecks of roots or cuttings will be required.—Turnip seed. For a seed-bed four feet wide by thirty in length, the plants being allowed to remain and thinned to eight or nine inches distance, half an ounce of seed will be required.—Carrot seed. Mix the seeds with dry sand, and rub them well to part them, for convenience in sowing. For a bed four feet by thirty-five, one ounce will be required, and the same for 160 feet of drill.—Parsnip seed. For a bed five feet by twenty-four in length, half an ounce is enough.

Spinaceous seeds.—Spinage. This seed is generally sown broad-cast; and for a bed five feet wide by twenty-five feet in length, two ounces will be required; if sown in drills, one ounce will sow the same space; in drills it is easier to weed and gather the crops. The drills should be from nine to twelve inches apart.—White Beet. For a bed five feet wide by twelve in length, one ounce is required.

Alliaceous seeds.—Onions. When onions are meant to be drawn young, two ounces of seed will be required for a bed four feet by thirty in length. But if allowed to remain for bulbing, one ounce will be enough for a bed five feet by twenty-five in length.—Leek, from seed; it may be raised from offsets. For a bed four feet by eight feet in length, one ounce of seed is required.

Asparaginous seeds.—Asparagus. If sown to transplant; for a bed five feet wide by eight feet in length, one quart of seed will be required. If sown to remain; for a bed five feet wide by twenty-four feet in length, one pint will do.—Seakale. If sown to transplant; for a seed-bed four feet wide by eight feet, sown in drills ten or twelve inches apart, by eight inches in the row, two ounces will be required. If sown to remain; then this quantity will serve for a plot of ground five feet by sixteen feet, sown in drills two feet apart.

Acetacious seed.—Lettuce. For a bed four feet wide by twelve in length, a quarter of an ounce will do, and will produce 400 plants or more.—Endive. For a seed-bed four feet by twelve in length, a quarter of an ounce will do.—Celery. For a seed-bed, five feet by eight feet in length, half an ounce will be required.

I am, &c.

H. C. Botanic Garden; ROBERT ROSS,
December 9th, 1845. *Head Gardener.*

Replies to queries regarding Manures, as applied in the District of Rungpore. Communicated by H. REHLING, ESQ.

To JAMES HUME, ESQ., *Secretary Agricultural Society, Calcutta.*

MY DEAR SIR,—I have to throw myself entirely on your indulgence, for having now been a Member of the Society for upwards of a year and a half, without noticing the queries concerning manure, drawn up by Dr. Lyon Playfair, and published in the Society's Journal, Vol. I. page 207, and republished in Vol. II., accompanied by an appeal to the public, to come forward with communications on the subject of manures. As the Rungpore ryotts pay a great deal of attention in improving their lands by the application of manures,

I have, herewith, the pleasure of submitting to you, some remarks, which have come before my notice, relative to this important subject:—

1. Is much value attached to the urine of animals as a manure, and in what state is it applied? What animal is considered to afford the best urine for manure, and to what kind of crops is it applied?

The natives of Rungpore do not go to the trouble of collecting the urine of animals, although, they are well aware of its value; this, I suppose, is more owing to the difficulty they would have in collecting the stale of animals, than to a disregard of its value.

3. Is much night soil (human fæces) used for the purposes of manure? How is it prepared for this purpose, and to what extent is it applied per acre? What kinds of plants are found to be most benefited by it?

Cast and habits of a Bengalee, have got a too powerful hold of him to induce him to make use of human fæces as a manure.

4. State particularly, how the dung reservoirs are made, (if protected from evaporation, &c. &c.;) and what substances are usually thrown into them?

Much attention is not paid to the size, or shape, of dung reservoirs; they generally consist of small pits dug in an elevated corner of a field; when the pit is full, a layer of earth is laid over it, and the dung left to ferment; many have no dung reservoir, but heap up the dung in a convenient part of a field; the dung is generally mixed up with the straw the cattle get to lay upon during night.

5. State whether animal manures are applied fresh, or in a state of putrefaction.

Animal manures are generally applied in a putrified or decomposed state; it is sometimes also applied fresh, when it is invariably applied to young plants that have been planted out.

6. State what mineral manures are used, such as lime, gypsum, saltpetre, &c. &c.; specifying the quantities per acre, the crops to which they are applied; and the manner of their application?

Mineral manures are never made use of.

7. Is the land ever left fallow, and if so, how often in twenty years?

The land is sometimes left fallow, if the ryott has lands to spare, which is not generally the case; on the poorer lands, only one crop of paddy is taken off yearly; whilst the richer lands yield two paddy crops, and besides, a *Kalaye* (gram) crop.

8. Is there any rule for the rotation of crops; that is, is there any succession of crops which are found to grow best one after the other?

Rules for rotation of crops are occasionally attended to; lands from which two or three crops of indigo have been taken off in succession, can never produce a good crop of tobacco; it is said, the leaves become yellow before the plant has come to maturity. Sowing wheat and barley, year after year, on the same lands, is said to exhaust the soil; mustard seed is generally sown in the lands, that have the previous year been occupied by wheat; the lands are then manured with oil-cake. *Kalaye* and all species of gram are said to draw but little nourishment from the soil, and tend in some measure to improve the same, yielding abundance of large leaves, which, when the crop is taken up, are burnt on the lands. Heavy stiff lands are generally sown with *Kalaye* in the months of August and September, and when it is in full blossom, it is ploughed into the ground; this process is said not only to impart richness to the soil, but tends also to loosen it and keep it cool and moist. Indigo is considered to exhaust the soil very much; and two successive crops of the same, cannot be raised with advantage on the same land, unless it is well manured.

9. Are the ashes of burnt plants or wood, used for manures? If so, what ashes are preferred, and to what crops are they furnished?

Ashes of burnt weed, wood, straw, cow dung and paddy husks, are carefully collected and applied as manure; it is generally applied to cold weather crops, as wheat, mustard, barley, &c., when they have appeared about 4 or 5 inches above ground. No difference is made with regard to ashes obtained from different substances. Ashes obtained from Indigo weed, is destructive to vegetation; I have no doubt, that if it is applied in moderation, that it will fertilize; but I have never made the experiment. As some important discovery might be made on this subject, I have the pleasure to enclose a small parcel of ashes, to be subjected to a chemical analysis; for the weed itself is a powerful manure, and which I shall notice hereafter.

10. Is flesh or blood held in esteem as manure?

Flesh or blood is never made use of, but I have seen rotten fish applied as manure to trees; in which case, the soil is removed, round the root of the tree, and the roots laid bare; after having allowed it to remain so for a couple of days, the fish is applied to the roots, intermixed with fragments of pots and paddy husks, and covered up with earth.

11. Are the ground bones of animals used as manure, or, are they thought much of?

The Rungpore ryott is too much a slave to his cast and prejudice, to make use of bones as manure.

12. Is saltpetre ever used as manure; if so, to what kinds of land is it applied? Is it used before sowing; along with seed; or after the blade is up?

Saltpetre is never used as a manure; neither is its value known, nor can the ryotts afford to use it.

13. Is much value attached to the dung of domestic animals, such as the cow, horse, sheep, elephant, goats, &c.; and which animal furnishes the best manure? Are the excrements of snakes used or valued?

Much value is attached to the dung of cows, sheep, and goats; that of horses is sometimes objected to, on account of its causing weeds, which I can hardly think is the case, when applied in a decomposed state. I have not seen dung of elephants made use of, neither the excrements of snakes; the latter, it would be difficult to procure.

14. Is common salt used much as a manure? If so, to what crops, and to what kind of lands?

Salt is never used as manure; many ryotts have often not even the means of using it in their food.

15. What kinds of manure are found to answer best for bamboos? What for rice? What for Indian corn, &c.?

Bamboos are never manured, but when they show a tendency not to thrive, which generally occurs when the knotty roots get above ground, a ditch is dug on each side of the hedge, and the roots covered up with earth, as all lands attached to bamboo hedges get exhausted: the above tends also to improve those lands, as the small roots of bamboos, spreading to a considerable distance round the hedges, are cut over, and thereby prevented from drawing nourishment from the adjoining fields. Much attention is not paid to the choice of manures for rice, &c., as they generally take whatever is at hand.

16. Is burned clay ever used as a manure?

I have seen pounded bricks *(soorky)*, applied in gardens; but I have never seen it used on a large scale in agricultural operations.

18. Can corn be grown for three years in succession on any land; or for how many years can crops of corn plants be obtained in succession?

Corn may be grown three or any number of years in succession, on all rich lands that are yearly well manured and tilled. Wheat, barley and oats, as I have above stated, exhausts the soil, and cannot be sown in succession, unless the lands are well manured

19. State all the different substances usually employed as manure, and all those you have heard, have been employed.

The substances used as manure, besides what I have already mentioned, are:—

First. Decomposed vegetable substances; amongst these stands foremost Indigo weed, which is thrown out of the vats after the plant has been steeped in water and undergone fermentation; this is made use of either in a state of decomposition as cow dung, or it is applied to fields just after having been thrown out of the vat; this latter practice takes place during the rains, and is managed as follows:—The field to be manured, having previously been ploughed up, the weed is conveyed to it, and spread in circular heaps, about six feet in diameter, and the heaps about eight and ten feet apart, care being taken to make all the tops or leafy parts of the weed meet in the centre; after having heaped up the weed to the thickness of eight and nine inches, it is covered up with earth, and is allowed to remain so for about one month, during which time the earth which has been thrown over the weed, combined with occasional showers of rain, promotes a decomposition of the weed; when the land is ploughed up and prepared for the reception of seeds or plants. The effects of this process is wonderful, for I have often seen the finest crop of tobacco raised on very poor soil, manured with indigo weed, previous to which it had not been capable of supporting the vegetation of the most hardy plants.

Secondly. Water drawn off from Indigo vats, after the separation and precipitation of the coloring matter has been effected, is one of the best agents for enriching poor lands I know of, and very much appreciated by ryotts, who, when they have lands attached to an Indigo factory, are very particular in digging drains, and leading the water into their fields. Its application consists in inundating the land to be manured, for several days; after the water is evaporated, a black substance is deposited on the surface of the soil, when the

land is ploughed up and prepared for sowing. It may, perhaps, not be thought out of place to quote an instance of its fertilizing power. Adjoining the works at this factory, I have a spot of ground, which contained a very poor soil, on which I could not grow any thing to advantage, till a couple of years ago, I dug a drain and led the water from my vats into it, and inundated the same with it: after the manufacturing season, I ploughed up the land and sowed it with oats, which sprung up most luxuriantly, and within a short time attained the height of five feet, with fine, large, broad leaves of a dark green hue, but the stocks not being able to support the weight, they were soon thrown to the ground, and completely rotted, before the grains could come to perfection. I have since had several fine crops on the same land; and since last year, I have turned it into a vegetable garden with success, and at present it contains the best soil at this place.

Thirdly. Oil-cake obtained from mustard seed, is a very powerful manure, and very extensively used here; it is applied both before, and after sowing or planting; it is generally applied before, and ploughed into the ground when it is to be sown with grain and seed, as wheat, barley, oil seeds, &c.; but in case a field planted out with plants is to be manured, the oil-cake is applied after planting. To sugar-cane fields, it is generally applied once before planting, and twice after the plant has appeared above ground, and then always previous to weeding the field; by which process, the soil gets stirred up and the oil-cake well mixed with it. The usual proportion for a biggah (2,500 square yards) is between five and six maunds, according to the quality of soil. Lands manured with oil-cake, will require the application of the same every year. Oil-cake soaked in water and made into a soft substance, is applied to sugar-cane tops, previous to planting; this prevents the young plant from being attacked by white-ants.

20. Is it true, that few or no weeds are to be seen in the corn fields of China, and do the Chinese ever use animal manures (not human) for their corn fields?

In this part, the cultivators take great pains in clearing their lands from weeds, and although they weed their lands two or three times yearly, they have a great deal of trouble in keeping their lands clear from weeds; and a ryott cannot expect a good crop, unless he weeds his lands.

21. Is it customary to apply the manure on the lands, or are the plants themselves manured?

Manure is generally applied before sowing, and before and after planting young plants out. When a field shows symptoms of not thriving, pounded oil-cake and ashes are applied to it, and the soil stirred about.

22. Is it the case, that the seeds of plants are often steeped in urine before being planted?

Seed is never steeped in urine, but if Paddy plant is to be raised for transplantation, the seed is soaked in water for a day, and tied up in a piece of cloth till it shows symptoms of germination, when it is sown on the surface of a spot of ground, previously worked with water into a soft mud.

23. Is it at all customary to burn the straw of plants, and strew the ashes on the field, or to return it unburnt to the soil?

All species of weeds, and straw of plants and Paddy husks, are burnt and strewn on the field.

Remarks.—Since the establishment of Indigo factories in this District, whole tracts of waste lands, consisting of sand with very little sub-soil, have been brought under cultivation, by the application of Indigo weed as manure; and as this manure is very much appreciated by the ryotts here, and it may be interesting to ascertain its components, I have the pleasure of enclosing three papers containing, 1st.—The weed in a state of decomposition. 2d.—Some soil manured with the

refuse water from the Indigo vats. 3d.—Ashcs obtained from burnt Indigo weed: and shall feel obliged by your adopting some means to subject the same to a chemical analysis.*

I remain, &c.
H. REHLING.

Chandamaree, Rungpore;
14*th October,* 1845.

Correspondence relative to the mode of cultivating and preparing Munjeet, in various parts of India.

[The Committee of Papers deem it necessary to offer some explanation for the delay which has taken place in publishing the greater part of the following interesting correspondence. The correspondenco originated in a suggestion made by a Member at tho general meeting in February, 1844, and adopted by the Society, to institute some enquiry into tho mode of cultivating and preparing Munject, or Indian Madder *(Rubia cordifolia),* in the localities whero it is principally grown, with the view of ascertaining, if, by a better mode of culture and a more careful preparation, the quality of the article could be sufficiently improved to enter into a closer commercial competition with the well known Madder *(Rubia tinctorum)* of Enrope. Shortly after the receipt of these communications, the specimens of Munjeet obtained from Major Lawrence, and Dr. Campbell, as also a few which were forwarded from Assam by Major Jenkins, were referred to a competent authority for chemical analysis; the lato Mr. Griffith offering, at the same time, to give a botanical account of the plant, and to draw up from the correspondence, a systematio paper on the subject generally, so soon as a sufficient comparison of the specimens had been made. The lamented death of this eminont Botanist having frustrated this intention, and the Society having failed hitherto, from unavoidable causes, in obtaining analyses of the specimens in question, the Committee think it desirable no longer to delay the publication of the correspondence in its original form, leaving any additional information, that may be hereafter obtained, to form the subject of a separate paper.

Many of the readers of this Journal, may not be aware, that Munjeet is the drug used in this country, from time immemorial, for topical dyeing upon silk cloth, especially the Cossim Bazar handkerchiefs, called *Chappas,* on which it

* These specimens have not yet reached the Society.—EDS.

produces many shades of red, from a pale pink to crimson, a variety of brown and chocolate hues, and every shade betwixt light purple and deep black. Munjeet is known and used for similar purposes in England, and its export has recently increased considerably; but as the article is bulky in comparison with its value, the high cost of transport will probably prove an obstacle to its extensive use. The color of Munjeet does not fix so readily on wool or cotton as on silk; but we have valuable indigenous dyes, in the varieties of Morinda, which it is extremely probable would, if applied according to the processes of Haussmann, or Papillon, produce colors not much inferior to the Turkey or Adrianople red. The subject is well deserving of every attention, and the Committee trust, that some of the correspondents of the Society will enable them to communicate further particulars thereon.]

To JAMES HUME, ESQ., *Honorary Secretary to the Agricultural Society of Calcutta.*

DEAR SIR,—I beg to acknowledge the receipt of your favor of the 29th ultimo, with its enclosure regarding the production and cultivation of Madder. Your correspondent has been led into error in supposing that Munjeet, or Indian Madder, is cultivated or produced here. Munjeet is solely produced in Nipal, and the higher ranges of hills bordering upon the Morung; whence it is brought by the natives of the hills for sale in this district.

It is brought here by the Native Mahajuns, and sent to Calcutta; this may have given rise to the idea, that it was a natural production of this district. The Munjeet is said to be the *Rubia cordifolia,* quite distinct from *Rubia tinctorum,* and is reckoned much inferior as a dye.

When at Darjeeling, I observed either the Munjeet, or a nearly allied species, growing abundantly wild in the neighboring forests, from which circumstance, I should suppose, that it was partly gathered in the wild state, and this latter circumstance may account for its inferiority. Perhaps Dr. Campbell at Darjeeling, or Mr. Hodgson at Nipal, could give more correct information on this subject.

Purneah; I remain, &c.

9th February, 1844. J. F. CATHCART.

Dear Sir,—In the *Calcutta Star* of the 20th instant, there is a report of the Proceedings of the Agricultural Society, in which Dr. Griffith announces his intention of drawing up for the Society an account of the Indian Munjeet, and submitting to the next meeting of the Society, a sample of the plant sent to him lately by me, with the view of comparing it with other Indian specimens, and with the Madder of Europe.

I am anxious, that the samples alluded to, should not be taken as fair ones in the comparison to be instituted, and if your Society should meet, before I can furnish Dr. Griffith with others, I shall feel much obliged by your letting Dr. Griffith peruse this note.

The samples sent, were, when they left this, unripe and alive. I procured them in that state, to enable Dr. Griffith to try and grow the plant in the Botanical Garden, as he had a short time before informed me, that it was an object of commercial importance, to increase the export of Munjeet from India; and so far as I recollect, he expressed his desire to try the growth of the plant in his garden. From this neighborhood, two sorts of Munjeet are exported to the plains, a cultivated and the wild one mentioned by Mr. Cathcart. The cultivated one is the richer in dye, but the wild one yields an equally good dye, I believe, but less in quantity. I have traversed hill sides of the wild plant in the Eastern parts of Nipal, and seen a good deal of it in Sikim. It thrives best at elevations of 4 to 5,000 feet, and is cultivated at similar heights, and also at lower elevations. The long tendrils are cut into pieces of a foot long and laid in the ground, partially delved with the tree stumps remaining.

The plant grows over the stumps, and trails along the ground, forming elegant clumps. The Munjeet cut up and laid down as above noted, springs from every joint; and it was in a fit state for laying down, that I sent the samples to Dr. Griffith. I fear, however, that I omitted to tell him this; and

hence his intention of reporting upon its coloring matter, and the loss of an opportunity to try its cultivation in Bengal. This I shall again afford him in the proper season, and shall, as soon as possible, give him an opportunity of testing the value, as a dye stuff, of the ripe and prepared plant. It cannot be grown from the plant as exported and fit for use; as after it is ripe, it is subjected to the action of fire, and singed. This process adds to the quantity and quality of the dye, and preserves the article from decay. Cultivated Munjeet is raised from seed as well as from cuttings, and the former is the better mode, but being a more troublesome one, is less practised hereabouts, where the cultivators are not very industrious. The sowing season hereabouts is April and May. It is reaped in October and November, and sent to the plains during the cold weather.

Darjeeling; Yours, &c.
February 25th, 1844. A. CAMPBELL.

DEAR SIR,—I have received yours of the 16th instant, and am glad you were pleased with the contents of my note of the 25th February regarding the Munjeet. You desire any further information on the subject that I can give you. This is not much, for although I had abundant opportunity, while in Nipal, the great producing country of this article, of learning all about the plant, its uses in the arts, and its commercial distribution, I have not any thing on record regarding it.

As you expect to hear from Major Lawrence on the subject, I need not tax my memory further than to state, that the Munjeet grows throughout the whole course of the central hills of Nipal, and in a great portion of the upper region, which is bounded by the snowy range. That it is exported thence to the plains of India, by a great many routes and through the Keroong, Rooti, and other passes of the Himalaya into Thibet. In both countries, as well as in Nipal, its use is confined to dyeing; although in the latter, much less

of it is consumed than in the others. In Thibet, woollens are alone worn and always dyed. In India, the dye is used on silk or cotton. In Nipal plain cottons are the general wear, so that its use is confined to the dyeing of coarse chintzes and the woollens of the Bhotiahs, who live near the snows.

From Cathmandu, the Munjeet is exported to the plains during the cold season in porter loads of 32 *dhârnis*, or 2 maunds and 16 seers each, by the Cheesa Gurhy and Etounda route to Bettiah, Kessariah, Lallgunge, and Govindgunge on the Gunduk. From Nipal, east of Cathmandu, it is exported by the Surduli-gurby route to Junikpore and Darbunga; and by Baraha Chuttra and Beejapore to Nauthpore, Allygunge, Sahibgunge, Purncah, &c. From Nipal west of Cathmandu, by Chitwun Bilwun to Ramnuggur, Bettiah, &c.; by Bootwul to Lotun Pali, Gorukpoor, &c. and by Dhoongya Gurhy to Toolsipore, Devi Patan, and Bulrampoor on the Oude frontier.

I believe that Munjeet is also exported from Kumaon to the plains, although it is not specified in Traill's list of exports to India from that province. In his report on the Bhotia Mehals of Kumaon, Mr. Traill, says, "The Manjith is here extremely abundant; but except for local consumption is in no demand."

From the Himalaya east of Nipal, the Munjeet is exported from Sikim and Darjeeling by Dimali Gola, Punkabari and Subbok Gola, to Kishengunge, Devigunge, &c. From western Bootan by the Lucki, Buxa, and other Dooars to Rungpore, &c.; and from eastern Bootan, by the Assam Dooars into that province.

The range of country producing the Munjeet is, therefore, of immense extent, embracing, as I believe it does, the whole of the central region of the Himalaya from the Sutlege to the most easterly feeder of the Burrumpootur. Although I cannot at this moment refer to an authority on the subject, I think it is also found among the mountains of Cashmeer.

The following is the method employed hereabouts in dyeing with the Munjeet. Woollens take the dye better than cottons, but it is used on both, and in the plains on silk. The cloth is first steeped and boiled in a decoction of the dried and pounded leaves of a tree called Song-gay by the Bhotiahs. I send you some of the leaves,* they resemble those of the tea tree. The tree is common at Darjeeling and is a Camellia (I think.) After the use of this mordant, the cloth is dried by exposure to the sun, and then boiled and steeped in a decoction of the Munjeet to which is generally added a portion of the ferruginous deposits of the chalybcate springs, which are numerous in Sikim. The metallic earth is said to fix the color and to give it brightness, and the quantity used is proportioned to the depth of shades required. The tints of the Munjeet dye vary from a light crimson to a claret purple. The deeper shades (purples) are produced by adding a decoction of walnut-tree root to the Munjeet and ferruginous earth. Other stuffs are also used to produce different tints. Among them is the Himalayan rhubarb, according to Traill, who says, "It is somewhat inferior in its color and properties to the Turkey; and the Bhotiahs do not take it inwardly, though they apply the powder to wounds and bruises; *it is also used as an ingredient in the formation of a red dye in conjunction with Manjith and Potash.*"

I send two specimens of Thibet blanket, dyed by the Munjeet of different shades of crimson, and shall forward others, when I have an opportunity. These Munjeet colors are the most popular among the Thibetans and the Bhotiahs of Sikim, among whom it is the distinguishing dress of one order of the Lamas, as well as common with the laity. They are also used in Bootan, but there the yellow colors are most admired, and the order of Lamas who wear that color are more numerous than those of the purple garb. English broad-cloths of

* These leaves were shewn to the late Mr. Griffith and considered by him to belong to a species of Symplocos.—Eds.

strong coarse fabric, intended for sale among Bhotiahs, should always be of shades of crimson, purple, brown, and yellow, and you might do well to ask the attention of your mercantile friends to this fact. There is a good deal of Munjeet exported from Sikim into Thibet, where the dyers are superior to those on this side of the snows.

I hope to send you a batch of Munjeet seed, soon. It is sown broad-cast, and when the land is not thickly studded with stumps—rarely the case—poles are put in for the plant to twine round. It is stronger and better when able to climb, than when obliged to spread on the ground.

Darjeeling; Yours, &c.
24th April, 1844. A. Campbell.

To Major H. M. Lawrence, *Resident at Nipal.*

Sir,—I beg to send what information I have been able to procure regarding the "Munjeet or Indian Madder;" but from the very great difficulty in procuring information at this place, I fear the sketch is but an imperfect one.

From all I can learn from different quarters, the locality of the Munjeet is of great extent, being found in great abundance through the whole of the central and northern hills of Nipal. By far the most superior kind, is brought from the hills close to the snows; that grown in the central hill, being much inferior in quality, and gives less dye.

The Munjeet is a creeper, and so far as I can learn, can hardly be said to be cultivated in Nipal.

In October, the seed is ripe, and spontaneously falls to the ground, and from which the young plants arise. In October, November, and December, the plant is ready for cutting; the long tendrils are alone used for dyeing, and these, being well dried, are made up into small bundles, and in this state brought to market.

It is said, that the plant thrives best in rather moist hollows between the hills. On the young plants appearing, the old ones are immediately rooted out by the villagers, this being all that is done in the way of cultivation.

In Nipal, the Munjeet is only used for dyeing cotton and woollen cloths, and horse-tails, but the consumption is not

great. A very large quantity is exported every year from Nipal, by the different mountain passes, into Purneah, Tirhoot, Chumparun, Goruckpore, and Oude districts, and from thence distributed throughout India. A good deal is also sent from Nipal into Thibet, were the Bhotiahs use it for coloring woollen blankets.

I have tried to find out the consumption of Munjeet in Nipal, and quantity exported to the Plains and Thibet, but without success.

The Munjeet is taken down to the Plains by coolies, each man carrying about two pucka maunds. The price of the best kind in the Cathmandoo bazar, is generally about Sa. Rs. 1-14-9, per Calcutta maund, equivalent to 80 English pounds.

The following is the method used in Nipal in dyeing with Munjeet. To dye a *than* or piece of cotton cloth, measuring twelve yards long and one broad, of a *red color*—"Put one seer of the dried leaves of the 'Assura' tree into some cold water, and let it stand exposed to the sun for nine or ten days, then strain and add a quarter seer of fresh bruised *huldee*, and four tola weights of *phitkeree* (alum), mixing the whole well together. Then let the cloth to be dyed, after being well washed and dried, be put into the above decoction and rubbed well with the hands for some time; and after drying it, let it again be washed with water,* (this will give a yellow color to the cloth). After this, put three seers of bruised Munjeet, into ten seers of boiling water, which is to be kept in that state for a short time, then put in the cloth, which is to be boiled, for about half an hour; a short time before taking out the cloth, put into the vessel, two tola weight of the dried leaves of the 'Sowah or Soongay' tree, and stir the whole well about, then take out the cloth and dry it, afterwards washing it well with the Balajee water."

If a fine deep red color be required, the cloth should undergo the above process two or three times. Different shades, from light red to dark purple, can be obtained from the Munjeet; the deeper shades are produced as follows—"Put the cloth already dyed red as described above, into a decoction of

* The only water used, is procured from Balajee, about two miles from the city of Cathmandoo.

the dried and bruised fruit of the 'Hurrah' tree, in the proportion of half a seer of the fruit to five seers of water, and after boiling it for some time, take out the cloth and dry it." This will produce a fine purple color; but should the tint be required still darker, the cloth is afterwards washed with the water of certain chalybeate springs found in the valley of Nipal; which fixes and brightens the color very much.

Should the chalybeate water not be forthcoming, the following is used for producing and developing the darker purple tints—"Take half a seer of *maida* (flour) and six seers of water, and after boiling it well, add two or two and a half seers of *keet* (iron cinder) heated, and let it stand for a few days exposed to the sun, when it will be ready for washing the cloth."

Specimens of the fresh and dried leaves of the "Assura" and "Sowah" trees, dried fruit of the "Hurrah" tree, as also Munjeet of the best quality, are herewith sent.

The seed of the Munjeet cannot be procured at present, but it shall be forwarded in October next.

Nipal Residency; I have, &c.
25th May, 1844. (Signed) R. Christie,
Residency Surgeon.

My dear Sir,—I have made enquiries regarding the Majeet, or Madder, which grows in the Saugor districts. There are two kinds. The best is a creeper (Bele) which grows in the jungly tracts east of Jubulpoor, towards the source of the Nerbudda river, in the Ramgur district. The people do not cultivate it. It grows spontaneously on the banks of running streams under the shade of large trees, and the stems spread along the ground, or entwine themselves on the trunks of trees. The roots are dug up by the Goands any time after the 1st of November, till the end of May, and sold to merchants, or bartered for equal weights of salt. The best is that taken up in February. This kind does not, that I can find, grow in any other part of the Saugor and Nerbudda Territories; or in any other part of India, that I have seen. The color taken from it, is a dark brown*; and the turbans of the 2nd Police

* In a subsequent note, Col. Sleeman mentions, that the Munjeet is made to produce every shade of red, purple, and even black, by the use of different mordants.

Battalion at Deemah, are dyed with it. Cloth dyed with this Majeet, is to be found in all bazars; but the roots are taken chiefly to Paulee in Rajpootana. The roots only are used. I have had some planted in the garden at Jubulpore; and am taking some with me to Jhansee to be planted; and the result will be communicated hereafter.

The second kind is the "Buheera Majeet," a very large tree, of which there are many in the Jubulpore and Houshungabad districts on both sides of the Nerbudda river. I will send you some leaves of this, as well as of the first kind, a creeper. The roots of this tree are also used in dyeing cloth, and no other part of it. What the color is, I know not. The sum of 125 rupees was offered not long ago for one of these trees. Some time ago 600 rupees were offered for another tree of the same kind, but still larger, in the Nursingpore district; and much larger sums, are said to have been paid for similar trees under the former Government in the Houshungabad district. This tree is said to give neither flowers nor seeds; and it is called "Buheera Majeet" from its resemblance to the Buheera tree, which is very common in these parts, from the flower of which a dye is said to be taken, but of what color, I know not.

The roots of the first kind or "Bole Majeet" sell in the bazar at from five to seven seers for the rupee. The district in which it grows is from two to three thousand feet above the level of the sea, and is well watered from running streams, and for the most part covered with jungle. The second kind grows in all kinds of soil, and far from water. The tree appears to be a very durable one, and as large as a Peepul tree. It would, I think, grow in any part of India; but the "Bole Majeet," which is thought the most valuable, seems to require a moist climate, with perhaps more cold than you could find in Bengal.

Goonwora, Camp; Yours, &c.
26th January, 1846. W. H. SLEEMAN.

THE JOURNAL

OF THE

ltural & Horticultural Society

OF

INDIA.

Report of the Operations at Broach, under the Superintendent of Cotton Experiments, during 1844-45.

(Communicated by the Government of Bombay.)

To James Hume, Esq., *Honorary Secretary Agricultural and Horticultural Society of India—Calcutta.*

Sir,—I am directed by the Honorable the Governor in Council to acknowledge the receipt of your letter, dated the 22nd April last, and to transmit, as therein requested, Copies (as per annexed list) of the papers, and reports received from Dr. Burn, Superintendent of the Government Cotton Experimental Farms at Broach.

I have, &c.,

R. K. Pringle,

Chief Secretary.

Bombay Castle : 5th June, 1846.

January, 1844.—All the month of January 1844, has been seasonable. Frost was very generally looked for and dreaded by the natives as not unlikely; unusual cold being often consequent on a heavy

monsoon. The prevailing winds of the month have been favorable, the dry cold NE., being about equally balanced by the number of days on which the moist and mild SW. has prevailed. On the 6th and 25th the atmosphere was so charged with moisture as to admit of a few large drops of rain falling.

The agricultural operations of the month have been merely watching the crops, and which is no light matter, the risks from thieves requiring watchmen in the fields both day and night: one man was caught helping himself to cotton in broad daylight. Mr. Hawley, is to commence to-day gathering the crop at Kokurwara. At Krode, the Bourbon variety has been ripening for sometime. The native produce there, it is expected, will be ready for commencing in about ten days more. The cotton crops are at least ten days behind: we began picking last year on the 20th of January.

The gin machinery is nearly ready for work. About the 10th instant probably the ginning of the new crop will commence, and, it is hoped, will be continued without interruption until May, at least, when all our attention will be required in the fields, preparing the land for the sowing-season in July.

(Signed) A. Burn,
Superintendent Cotton Experiments.

Broach: 1st February, 1844.

There has been no work done on the Kokurwara farm in this month.

(Signed) J. N. Hawley,
Government Cotton Planter.

January 31st, 1844.

February, 1844.—The beginning of February was attended by pleasant cool weather, SW. winds prevailing, and heavy dew falling at night, greatly to the advantage of the cotton crops. On the 2nd, a few drops of rain fell, and on the night of the 7th, a heavy shower. After this rain the weather continued steady and favorable to the end of the month.

2nd.—At the farms, the gathering of the crops has been the chief occupation of the month. Mr. Hawley's diary shows the quantities of kuppas that have been picked and ginned from Kokurwara.

3rd.—The gins have been in constant work since the 12th, and the alterations made in the gearing appears to answer, so much so, that it is thought to be now as complete as need be: eight pairs of bullocks can with ease keep the two gins at work from daylight till dusk.

4th.—Much difficulty has been experienced in obtaining laborers during the month. Higher wages have been given than is the custom of the district, almost uniformly from the commencement of the experiments, but still the people do not come willingly, and this dislike and unwillingness to give any assistance, appears to be increasing, so much so, that there is reason to fear for the possibility of conducting much longer the practical details of farm-work and labor, unless at a heavy expense, such as would not admit of the question of profit and loss being one of the tests of success. The people here are generally so well off, in regard to the essentials of food and clothing, that they can allow their prejudices considerable latitude in choosing what master they will serve, or indeed whether to work or not. The difficulty of obtaining laborers has been frequently brought to the notice of the Mamlutdar, and the Collector of the District, but their influence, from whatever cause, has always proved, though more or less effective at the time, of the most transient nature.

February 1st, 1844.—To-day commenced picking cotton on the Kokurwara farm.

Date.	Weight of Cotton Picked.			Weight of Cotton handed to the Gin.			Remarks.
	Bhors.	Dokras.	Seers.	Bhors.	Dokras.	Seers.	
1	2	8	41	..	..	..	
2	3	8	19	..	..	..	I endeavoured to have the cotton picked clean of trash, but as you objected to this, of course I could not have it done.
3	2	4	26	..	..	..	
5	..	5	1	..	..	..	
6	..	..	..	..	..	..	
7	..	..	..	..	..	..	
8	..	..	..	1	9	..	
9	1	15	44	3	..	..	
10	4	1	3	3	1	..	
12	2	12	7	2	9	..	
13	1	8	29	2	2	..	
14	1	17	9	2	18	..	
15	2	1	47	2	..	..	
16	1	3	9	1	5	27	
17	1	18	..	2	16	..	
19	2	16	40	2	11	21	
20	3	7	39	..	..	..	
21	..	..	..	..	..	..	
22	3	10	22	..	..	..	
23	..	..	..	..	..	..	
24	4	14	32	..	..	..	
26	5	2	8	3	7	..	
27	4	8	29	2	11	..	
28	..	..	..	..	..	..	
29	3	7	9	4	6	..	
		10	29	3	10	..	
Total.	53	3	11	37	6	..	

(Signed) J. N. HAWLEY,
Government Cotton Planter.

March, 1844.—Of the weather during the past month, I have nothing particular to remark, further than its having been seasonable. Southerly winds continued to blow frequently up to near the middle of the month. The gathering of the crop, of native seed cotton, from the farm at Kokurwara continued, and the produce was brought to the gins daily, as it was collected. On the 20th, seventy-seven bales were shipped off to Bombay, of which 23,553lbs. was cotton prepared by gin, and 3,130lbs. by native churka: this latter, for the sake of the comparison it will afford of the relative merits of the two modes. The

crop it is expected will be all gathered by the middle of April, when the hoeing up of the bushes, and preparation of the soil for the next crop, will commence: in hoeing up the old bushes much labor and expense is incurred, for every plant has to be cut over about two inches below the surface of the ground, otherwise it would sprout afresh, and the work is performed by men with sharp hoes. I have endeavoured to reduce the labor and expense of this operation by constructing an implement to be drawn by cattle, and from a trial of it lately made, it is hoped, that it will be quite suited to the purpose. With Mr. Hall's assistance, I have also during the month been engaged in constructing a harrow, and endeavouring to improve the construction of the native "kulub," so as to render it stronger and less subject to break, than the implement used by the natives. The usual routine operations of the month required no particular notice. I have been anxiously waiting for instructions as to the disposal of the wheat crop, as the season is so far advanced towards the monsoon, that I fear being able to dispatch the wheat to Bombay in time before the winds set in here.

April, 1844.—The weather during April has been seasonable. Until the 19th of the month, the usual heat gradually increased, accompanied by the customary dryness of the atmosphere. With the new moon of the 19th, a more steady wind from the westward set in, and the atmosphere began to regain a portion of moisture, an acquisition which usually continues to increase steadily, though slowly, till the setting in of the monsoon rains, and which I may notice, are from the seasonable nature of the weather, expected to be earlier than they were last year. On the 27th, the gathering of the cotton crop from the black soil was completed. The picking of the produce from the light soil plants is not yet wholly over. Upon the 22nd of April, cutting over the old cotton stalks, hoeing up thorns, and digging out grass roots and burning them, was begun, being the commencement of preparation for next season's crop.

May, 1844.—In this district the month of May has an importance, as finishing the old, and beginning the new year's work, in all that relates to the more important operations of tillage. In it, the gathering in and storing of the produce from the fields of the ripened crops, is completed, as well as the preparatory operations

upon the soil, for the sowing of the next season's crop, commenced. From the diary* attached, it will be seen how the people and cattle have been employed on the Kokurwara farm during the month. The total number of daily laborers in the month amounts to 860, which gives an average of sixty per diem: all the land has been got ready except about ten acres, and which will be finished off in a few days more. The hoeing up of the cotton stalks was noticed in last month's report as begun on the 22nd. This operation I got done by contract for sixty-eight rupees two annas. The contractor taking the field at 545 beegas, and at the rate of two annas per beega. This is the first preparatory operation, after which comes the hoeing up of thorns, a species of *ziziphus*, and which may be surmised, from the number of hands employed on the work, as noted in the diary, is very abundant on the land. Fortunately this plant, unlike another to be noticed, does not interfere very much with the growth of the cotton plants, although from its abundance and difficulty (almost amounting to impossibility) of extirpating, it adds greatly to the expense of cultivation wherever it exists, requiring to be cut over two or three times a year. Another thorn also is not uncommon, it is a species of *acacia*, and very tenacious of life; the roots, cut over many inches below the surface, sprout afresh, and these sprouts as they hinder the work of the bullock hoe, and often break it, require to be cut over once a year, at about a foot below the surface of the soil. The cotton stalks and thorns being all cut up, are finally collected into heaps and burnt, after which the land is ready for the cattle hoe, or kulub, and the more frequently it is hoed until the season for sowing arrives, the better it is made for the reception of seed. The great hardness, when dry, of the black soil, is an obstacle to its being sufficiently worked; no plough can stir it when parched, it is so hard, and all the kulub or bullock hoe does, is to scrape and loosen about two inches of the surface, and this much only when it has not been suffered to lay unworked after the rains cease, during the time it is drying. By passing this implement over the surface two or three times, however, great good is effected. The sun acts upon the loosened surface favorably, and the large cracks in all

* These diaries are omitted, being too lengthy for insertion.—Eds.

directions by which this soil is rent, have a great portion of the loose earth pushed into them. These cracks seem to be of the highest utility in maintaining the natural fertility of this soil, as they not only help to expose a larger portion of surface to the atmosphere, but being of great width and depth, it is not impossible to maintain a constantly recurring fresh surface annually: for, about two inches thick of surface, may be made to fall into them, and thus by the pulverized surface falling into the cracks, the roots of plants find an abundant and constantly renewed sustenance at the very place they require it most. Hence too, in great measure, may be explained, the seeming inexhaustible nature of this soil; and also a reason shown, for the inutility of the plough here, as used in England, for the turning down of the surface soil. The cracks seem to depend on the great absorbent power of the black soil for their cause. On trial, in May 1843, I found that it became saturated when about 38 per cent of water was added to it; and it appears generally to part with nearly the whole of this amount, to eighteen or twenty-four inches in depth, before the end of each hot season. Finding it impossible to use the English plough in this soil when dry, and perceiving the great value of having it well stirred on the surface in the hot weather, it occurred to me that the harrow would be a valuable implement in its preparation: accordingly, I got Mr. Hall to make up a wooden one, and as it proved on trial very serviceable, I had two iron ones made, containing sixty teeth in each, and of such weight as to be drawn by two pair of bullocks, walking abreast. These implements have been of great service, the style of their work being very superior to that done by the kulub; and it may be confidently hoped, that great economy will be obtained from the introduction of this implement in cotton culture, on the black soils. Harrows and grubbers, it is probable, would be far more valuable implements for the culture of the various soils of India, than the best English ploughs. Another operation of consequence carried on during the month, has been the digging up of the roots of the "Kaiva" grass. This is a grass which annoys the agriculturist very much, from the difficulty with which it is extirpated, and as it is peculiarly obnoxious to the growth of the cotton plants, wherever it finds place, it becomes highly necessary to root it up entirely. It

spreads in patches, till, if allowed, it would cover an entire field. The farm contained about fifteen acres in patches of various sizes, spread up and down in all directions. To root these out it is necessary to dig the soil to the depth of about twelve to eighteen inches; thus loosened, the roots are exposed to the heat of the sun, and being dried up, are rendered unfit to vegetate, and thus got rid of. The storing of a sufficient quantity of fodder for the cattle during the rainy season, has been completed in the month. A preference to "Kirby," the stalks of the Holcus sorgum, has been given over hay, the produce of the grass lands and hills of the Rajpeepla district; as the hay is not so nourishing, and less fit for supporting cattle when at hard work. The amount stored is 29,307 poolies or small bundles; also grain, muth, the produce of the Phaseolus aconitifolia, sufficient for the rains has been stored. At Karode, the work has been that of clearing the land of weeds, and cotton stalks, but this kind of labor is not so great on the alluvial as on the black soil. On the 5th of the month, the best part of the wheat crop of this farm was shipped to Bombay, with a view to its being sent to Liverpool, as an experiment to test the possibility of landing it in a sound state in England, and which it is hoped, may be found possible to accomplish, as the grain has been carefully cleaned, packed in bags of about half a hundred weight each, and being dispatched before the rainy season, immediately, or as soon as possible, after it was ripe. The gins have not been worked during the month, there has been no demand for them; and indeed May is the worst month for ginning in the whole year, as the dryness of the staple from the great heat, renders it more frangible than at other times. But independent of this, all the cattle have been required for farm labor.

June, 1844.—The month of May here, had been distinguished beyond that of ordinary seasons, by steady unbroken weather, generally considered indicative of an early and favorable monsoon by the husbandmen; and accordingly a cloudy, damp atmosphere with tendency to rain made its appearance early in June. From the Meteorological Register it will be seen, that the first shower of the season fell on the 5th, and that in all fifteen inches and fifty-two cents fell up to the end of the month—a large quantity, and much beyond the average of the last three years, which is five inches and

thirty-one cents only. However, the season as yet has been remarkably favorable to cotton culture, and should the excess of June be counterbalanced by a proportionate diminution in July and August, the prospect of a large crop will be almost certain: should, however, the remaining months of the monsoon bear a proportion of rain similar to June, there can be no doubt that the cotton crop will be reduced in amount even below that of last year. The general complaint here last season was injury to the cotton plant from the long duration of the rains, and of the accuracy of this opinion, some interesting information might be inferred from the amount shipped from the various sea-ports in Guzerat, as compared with previous seasons. I have obtained the monthly shipments from Broach for the two last seasons, and which show a deficiency of 25,336 bales in the season 1843-44, compared with that of 1842-43 which, although, I believe, not entirely depending on the bad season, is mainly to be ascribed to it.

The land at the Kokurwara farm was ready for the rain, and immediately the weather cleared sufficiently after the soil was fairly moistened, the operation of sowing commenced. This was on the 26th as will be seen from the diary, and up to this date has engaged the unremitting attention and anxious solicitude of every individual belonging to the farm. Half the land has been completed, and already the first two days sowings have begun to appear above ground: should the rain hold off for four days more, and which will be very advantageous, the whole of the seed will be got into the ground in the most favorable manner. It was with some difficulty that part of the buildings sanctioned by Government, 16th May 1844, for the work people on the farm, were got ready for them to reside in previous to the rain setting in. On the wet days the farm servants exerted themselves beyond usual, or much damage probably would have been sustained by the half finished buildings. Occasions of this sort are often not without their good results, one remark it enables me to confirm, and which it may be worth noticing here, viz. the superiority of the "Bora" cast of "cultivators" over all others in this part of India. In point of bodily strength and energy, they generally exceed any Musulman or Hindoo cultivators of the soil, and from their steady habits and patient endurance of labor, they seem eminently qualified for carrying out any improvements in

practical agriculture, which may be wished here. Both the patels in charge of the farms are Boras, and at Kokurwara there are now twelve of this cast monthly laborers. I have taken some trouble to ascertain the history of this people. They are quite different, and distinct, from the well known merchant Boras who frequent Bombay, Surat, and other large cities. It appears they were originally Hindoos, resident near Dholka, in the Ahmedabad Purgunnah, when Mahomud Begra, minister of one of the Sultans of Guzerat, about 200 years back, forced them to become Mahomedans. Further persecution drove some of them from that part of the country, and having obtained leave from the Nawab of Broach to settle on a part of his territory, they gradually cleared away the jungle and planted the sites of different villages at various distances round Broach. In doing any thing on a large scale in the way of farming, or introducing improved modes of tillage, into this part of the country, much may be hoped for by gaining the good-will of the Boras. They are a tolerably numerous class, and the population of their villages seems on the increase; they are completely free from debilitating vices of drunkenness and opium eating. They use wholesome substantial food. Although Mahomedans, they understand almost nothing of the faith, leaving it all to the priests, and seem to care proportionably little about it; their grand aim appears a wish to have a comfortable house, a reputable wife, and all the other comforts and necessaries which long devotion to rural pursuits (would it may be concluded,) naturally induce. In the character of the Bora will be found much room for improvement, although in point of veracity, he is on a par with the Hindoo and Musulman; still where there is such energy of mind, and physical development of body, such strong appetites for the useful and ornamental products of human industry, such determined abstinence from the means of exhilarating debauch, there must of necessity, at sometime, exist a fine field for improvement. A rich soil for produce, but of course to be cleared of its natural weeds and thorns; a seedling like the crab-apple, which requires but a healthy graft when it will yield crops of golden fruit. All the boys and girls who come to gather the kuppas, and to weed the thorns from the land at Kokurwara, are from the Bora villages, and more healthy intelligent children, I have rarely seen: very few of them go to school, which is to be regretted, as a little education might doubt-

less be the means of adding to their happiness, and assisting their desires to obtain the comforts and necessaries of life. There is no English school in Broach, and the natives generally would not pay any thing towards it, if there were one. But I think in reasonable time its benefits would be fully appreciated by all parties. It is the apathy, the want of all desire to improve any way, which renders the prospects of all kinds of improvement among the great body of Hindoos and Musulmans, so dull and hopeless.

Kurode farm has not been visited by me during the month, owing to the distance and difficulty of communication now, since the boat has been disallowed me. The work of sowing commenced there on the 20th, and half the sowings have been completed.

Two applications to gin small quantities of kuppas, have been received and accepted during the month, but the cattle cannot be spared at this season from the more urgent and important operations of tillage: still when the sowing of the seed is completed, I hope to be able to employ the bullocks at the gin house.

It only remains to notice, that Mr. Hall has been occupied during the month, in preparing a machine to cut wheels for a small model of gearing for working gins by, and that the carpenter has been fully engaged in assisting at the erection of the sheds, &c., at Kokurwara.

Abstract of Cotton Bales Shipped from Broach for Bombay in Season 1842-43 *and* 1843-44.

Season 1842-43.		Season 1843-44.		
Months.	Number of Bales.	Months.	Number of Bales.	Remarks.
June, 1842,	..	June, 1842,	..	
July, ,,	..	July, ,,	..	
August, ,,	..	August, ,,	..	
September, ,,	679	September, ,,	..	
October, ,,	2,988	October, ,,	2,436	
November, ,,	4,262	November, ,,	2,034	Extracted from the Custom House book.
December, ,,	1,364	December, ,,	1,927	
January, 1843,	3,640	January, 1843,	2,156	
February, ,,	1,595	February, ,,	1,157	
March, ,,	4,119	March, ,,	3,162	
April, ,,	16,296	April, ,,	11,221	
May, ,,	18,758	May, ,,	4,272	
Total, ...	53,701	Total, ...	28,365	

ABSTRACT. 53,701 Season 1842-43.
28,365 Season 1843-44.
25,336 Difference.

July, 1844.—July has been a very anxious time to the cotton farmer, owing to the threatening nature of the weather, by the constancy of moisture. The Pluviometer indicates a fall of eleven inches fifty-one cents, and twenty-six rainy days, during the month. On the 11th the sowing of the land at Kokurwara was completed, and by the evening of Saturday the 13th, all the resowings of portions, where the seed had been rotted by the rain, or buried by it, were finished; and had the heavy rain held off then for six or eight days, the whole crop would probably have got up sufficiently to be beyond the reach of danger from any ordinary fall. But it so happened that from the 14th to the 28th, the fall of rain was so constant as to destroy nearly half the young plants, besides prevent almost all endeavour at resowing from the wet state of the soil. On the 27th the weather had so far cleared as to admit of another attempt at resowing, by dibbling in seed, between the plants which remained. Part of the land, which was last sown, and where the water, from its laying low, could not readily run off, it was found necessary to sow afresh entirely; this was begun as is shown in the diary on the 30th. Both these operations are now progressing and will probably be completed in a few days, should the rain hold off; and in the event of which, there is still ample room to hope that a fair and good crop may yet be reaped this season. On the land first sown, and which stands higher than the rest, little or no injury has been sustained, and the plants now average about a foot in height and are very promising. The American method of ridging up the soil in rows, upon the top of which the seed is sown, has certainly a great recommendation, particularly for low places where water drains but slowly off, as it keeps the young plants out of the wet, which, when standing close round their stem, for even forty-eight hours, is certain to destroy them. The native modes of agriculture here, have no provision for drainage; the plants are obliged to stand the chance of the seasons being either extremes of moisture or dryness, upon a perfectly level surface, or at least, the soil of each field is every where made as smooth as possible. It is not impossible, however, I think, to introduce a modified kind of ridging in sowing cotton seed here, which will help in some degree to protect the young plants from the injury of excessive moisture, while at the same time it shall not expose them too much to the other extreme of injury, increase of deficient

moisture, from a monsoon fall of rain below the average. At a future time I shall not forget to endeavour to put this plan in practice. From the monthly diary it will be seen that part of the laborers and farm cattle were employed in working the cotton gins during the period, when all field work was at a stand still from the heavy rain. The economy of gin machinery will in this way be much enhanced. All farm labor when systematically arranged and provided for, is brought thereby nearest and most speedily to perfection. Idle days are the bane of progress, and it is hoped now that when there is no field work or labor for the cattle, that employment will be found for them at the gin house.

August, 1844.—This season, although not nearly so moist as last, has still not been favorable to the cotton farmer; the very unusual fall of rain at the commencement in June, gave such strength to the vegetation of the numerous varieties of annual weeds and grasses, that extraordinary labor, and repeated hoeings, became necessary to keep them down; thus not only adding to the expense of cultivation, but detracting from the healthy and vigorous growth of the young cotton plants at a very important stage of their existence. Last year there were twenty-two rainy days, and a fall of fourteen inches fifty-seven cents and a half during this month; and in this year, there has been twenty-one days on which rain has fallen, and an amount of four inches and fifty-three cents of rain only. Thus exhibiting a less quantity this year, of ten inches four cents and a half. The diminished amount, however, has not been sufficient to admit of favorable circumstances, for it will be seen in the register, that very few days were without a small quantity of rain falling, just enough in fact to keep the soil in too moist a state for favorable work. The diary shows there were only fifteen days, during which the land could be worked in the month, owing principally to its being too wet, and that the number of days work got out of the "kullubs" bullock hoes, and which is the all important labor at this season, amounted to 186½ only, whereas the full amount of labor would have been 441, thus showing a loss of 254½ days work, and which loss in a favorable or average rainy season would have been no more than 120 probably. The whole of the cotton has been hoed twice by hand, since the beginning of the season, up to the end of August, and all of it except a small portion has had the bul-

lock hoes passed between the drills once, and some of it twice and thrice. The small portion alluded to is in extent about ten beegas. Owing to the excess of moisture, the great bulk of the young plants remains stunted, but should September prove to be dry, in like proportion to August, (and as in the report for June was hoped would be, remainder of the season,) they will it is hoped still recover so as to yield a fair crop.

2nd.—The farm at Kurode has suffered nearly as much as it did last year from the heaviness of the monsoon, and it is to be feared quite as unfavorable a result will be found there as formerly. Part of the land where the cotton plants had been entirely destroyed, has been returned to the authorities at Broach, that it may be rented out for the culture of wheat, or other produce.

3rd.—From the diary it will be observed, that during the rainy weather, the bullocks and part of the people of the farms were employed at the saw gins. In all about forty bhars and a half of kuppas was ginned off. Mr. Hall has been engaged repairing the grates of one of the gins, and in preparing a model of a gin house, but his time has been somewhat cut up by sickness,—repeated attacks of intermittent fever.

September, 1844.—September has presented seasonable weather. The fall of rain amounts to five inches and forty-two cents, and the number of wet days has been ten. From the diary it will be observed that the farm labor or hoeing between the rows of plants with the bullock hoe has been the principal labor of the month, and that for about eight days only, owing to the wet state of the soil, has this labor been at all interrupted, the repetition of this operation is very conducive to the growth of the cotton plant. It keeps the surface soil loose, and free of weeds, and facilitates the growth of the tender roots, at the same time preventing the too rapid drying of the soil, a point of great consequence where the plants happen to have been kept back in growth, by too much, or too constant rain. When the land was too wet for working upon it, a part of the cattle were employed in the gin house.

October, 1844.—It may be stated in reference to the general character of the weather during the past month, that it has been according to season. The dry easterly winds prevailing which, together with the most powerful sun of all the months in the year,

have caused the rapid drying up of the surface of the soil. As the monsoon rain set in early, so it departed early, and in the beginning of October there was not the usual last shower of the season. But although there was no rain, it may be noticed there happened a very heavy fall of dew, so much so, that the mornings of the 16th and 17th, presented almost the appearance of a London fog. This dew fell nightly from the 12th to the 18th, and was very favorable to vegetation. From the register of the pluviometer, it appears that the fall of rain for the past season amounts to thirty-six inches and ninty-eight cents, that there were sixty-eight rainy and forty-three dry days out of 111, the period of the monsoon, supposing that period to count from the first shower on the 5th of June, to the last shower on the 24th of September. The fall of rain in 1843 was thirty-nine inches and sixty-five and a half cents, so the average for the two seasons 1843 and 1844 will be thirty-eight inches thirty-one and three quarter cents. This, however, I am inclined to consider a little higher than the true average fall at Broach, as the natives of the place say both seasons have been unusually heavy monsoons. But on the whole it is a small quantity when compared with the fall at Bombay, which if taken to be seventy-six and a half inches, shows a difference of thirty-eight inches eighteen and a quarter cents over Broach, or double in amount. These facts with others deducible from them, are very interesting, as affecting vegetation in general, and as leading to a correct knowledge of the application of means to successful tillage, in various agricultural operations. To those acquainted with the nature and habits of the common indigenous cotton plant, and who are capable of appreciating the value of the different agencies which affect its healthful growth, there will appear at once a striking explicative in this, for the superior fitness of the Broach districts in producing cotton; and to say that a distribution of the annual moisture, *cæteris paribus*, in any part of India, similar to that at Broach, wherever the "Black" or "cotton soil" exists, would determine its suitableness or otherwise, for a system of tillage, such as is pursued here by the natives with so much success, seems not too much to be expected. With the present limited experience, however, it might be premature to act on this inference alone, but there can hardly be a doubt as to the primary importance of moisture, and its distribution, on the various species of cotton plants, some of them

requiring more, others less, and, it appears equally clear, that had we a fall of rain here equal to that of Bombay, no culture of the indigenous cotton could be carried on; the plants would be killed by it.

2nd.—In reference to the comparative effects of the two seasons of 1843 and 1844 on the farm crop, this last has been the least favorable. As the heavy fall at the commencement of the monsoon in June, and the very continued rain of July when the plants are young and very susceptible, caused much injury to them. July is perhaps the most important month in the growth of the plant, as until it can get out its third or fourth set of leaves, and hardly till then, it is safe from hurt by the continuancy of moisture. Intervals of sufficient duration between the falls of rain, that hoeing and weeding may go on, are of the first importance to the health of the plant and even to its existence. The amount of rain in 1843, though a little in excess of 1844, fell, so as to admit of the operations of hoeing and weeding being conducted more fittingly than in 1844. Respecting the out-turn of produce that may be expected this season, it is very difficult at present to give any correct estimate, so much depends on the weather that may prevail during the next two months. The Overseer in charge considers the crop as promising a larger out-turn than last season, should there be no stint in the usual falls of dew, necessary to the ripening of the cotton pods. My own opinion does not rate it so high.

3rd.—No work has been done at the gin house during the month. Mr. Hall left *en route* for Bombay and Dharwar on the 15th, taking along with him a small model of a gin house, as a plan for the erection of machinery to be adopted on a large scale. In January next, will have been completed four years since the experiments here were commenced; and as rupees 3,000 per annum of rent is paid for the premises of Umjeed Bagh, besides upwards of rupees 10,000 on the construction of the gin houses, rupees 22,000 will have been expended on these two heads alone, and which must be considered as an expense highly unnecessary to be continued or added too, now that all that can be done has been done, in the way of settling the question in particular, of applying gin machinery to Broach cotton. As favorable reports on the qualities of the ginned cotton continue, it is to be hoped that, as early as possible, steps will be taken by Government to put the experiments upon a more

advanced ground. When the physical and moral well-being of the people of this country is considered so much an object at heart of all good men, and so anxiously prayed for and desiderated, it appears to me that, next to a Christian education of the young, hardly any thing could be conferred on them more likely to be of use to all parties, than the introduction of useful machinery, and the inventions and discoveries of modern science.

November, 1844.—There has occurred nothing of particular interest to report on during the past month. The weather has been general, and conducive to the growth of the crop of cotton in this district; inasmuch as there has been no very drying wind, generally a little dew falling over night, and less cold than usually appears at this season, particularly towards the end of the month. From the diary of the work at Kokurwara, which accompanies this report, it will be seen that the labor of field-work generally, has been light and easy compared with the previous months, consisting of hoeing with the bullock's hoe between the rows of plants where they are a little backward, digging up and cutting over thorns from among the plants, cutting and gathering in from the "Beers" or grass lands, the crop of hay for the cattle, also ploughing and cleaning a small portion of land which has been laid fallow. Besides this, attention has been given to a few other subjects, that of necessity had lain over, during the more urgent and important work of attending to the cotton crop since May last. Such as measuring the land, and ascertaining the amount under crop, &c. &c., finishing part of the cattle sheds, burning lime and collecting bricks to complete the building of the well, and attending to the state of the public road, which passes through the farm.

2nd.—With reference to the appearance of the crop, it is cheering to be able to state, that it promises as well as could be expected, all circumstances considered. A great deal has been done for the improvement of the soil since it came into my hands, and although much yet remains to be done for it, in the way of clearing it of weeds, and providing for the drainage of water that stands on the surface of a part during the monsoon; still the present crop bears sufficient evidence of the value of increased exertions and care in tillage, and I trust that the out-turn of produce will, at a future

date, when gathered, fully bear out this opinion. The crop although in appearance equal, at least to any round Broach, on the whole, is below what I expected it would be. This I attribute in great part to the injury done by the heavy rain at the commencement of the monsoon, and to the great difficulties met with in the management of the work people employed upon the farm.

3rd.—Some very fine produce from Sea-Island seed has been gathered during the month. It is only a sample in quantity however, from a few bushes grown in a little bit of *black soil*, which was fresh broken up during last hot season, and had a portion of lime applied as a manure. The plants were vigorous, grew above six feet high, yielded a fair quantity of produce, and without irrigation. Nothing can be augured very favorable to extended culture of this plant, however, from this experiment, unless a locality could be found, where the heat of the sun during October is less than at Broach. It is curious that lime, as a manure, seems to be unknown in native agriculture: as it may be readily believed, that it will be found useful, it is intended to try it fully on a part of the farm next season, wherever the small bulk of crop indicates that the strength of the soil most requires a tonic. A small quantity of produce has also been gathered from a new variety of cotton plant, obtained by crossing the two native species last season; the pollen of the *G. herbaceum* being used to impregnate the *G. arboreum.** This latter is the plant known as yielding what is commonly called the "Nurma Cotton," and being a very hardy kind of plant promises to yield in this way a variety that may be found as well suited to the climate as the parent, while at the same time it shall possess some of the superior qualities of those varieties with which it is crossed. The success in making new varieties of plants in this way, has long been well understood, particularly among florists. By this mode also have numerous excellent varieties of potatoe been obtained and of different cereal grains. The Hopeton oat, of late years become so famous in the Lothians, it is believed, was obtained by an accidental cross with the native wild oat, the hardy and suited to climate qualities of which, it eminently possesses.

* An interesting memorandum by Dr. Burn on this subject will be found in the fourth volume of this Journal.—Eds.

4th.—At the Amjud Bagh there has been no work going on as there is no kuppas to gin, or applicants for the use of the gins during the month.

December, 1844.—The weather of December has not been so cold as usual until towards the end of the month. After the full moon on the 24th, the cold at night has been such as to produce some of the effects of frost on the vegetation, growing in a few of the low and damp localities in the fields round Broach. There has also been a deficiency in the nocturnal dews, a circumstance usual, it is said, after heavy rainy seasons, such as the two last have been.

2nd.—The diary shows what has been done at the farm during the month. Preparing a small portion of fallow land, and looking to the repairs of the houses on the steading, and grazing the cattle, are the chief objects which have received attention. Except cutting over in some places the irradicable "Bori," thorn bushes, there has been nothing necessary for the growth of the cotton plants. These are now all in full blossom and growing vigorously. The want of work for the bullocks is a matter to attract notice. It might be remedied by having gin work for them, or more extended fallow land to prepare.

3rd.—Last month it was noticed, that a little produce had been gathered from a new variety of cotton plant made by crossing. During the month all the crop of kuppas from one plant has been picked;—it is very good. On weighing it was found to amount to four rupees and three quarters weight, or 855 Troy grains. For the sake of comparison, the same weight of kuppas from the "Nurma," variety of plant was examined at the same time,—the results were as follows:

Cross plant, wool grains, ...	239	=	28	per cent.
———— seed, ...	607½	=	71	ditto.
———— loss and dust, ..	8½	=	1	ditto.
	855		100	
Nurma plant, wool grains, .. .	191¼	=	22¼	per cent.
———— seed, ...	658	=	77	ditto.
———— loss and dust, ..	5¾	=	0¾	ditto.
	855		100	

Thus it is evident that improvement as to quantity of wool has been one result of the crossing: 28 per cent. is equal I believe to the yield of the best New Orleans produce, and in this instance the quality of the wool is in my opinion quite equal to it. If an acre of land were planted with 7,000 plants and yielded the rate above stated, or take it only at 720 grains from each plant, then the wool would amount to 201 ℔s., and at 4 pence per pound, or 6 ℔s. per rupee, its value would be thirty-four rupees. The botanical characters of the whole plant are more or less in appearance a combination of those of the parent. Like in the best Broach cotton plant the seeds too have become of smaller size, and less wooly, than are those of the Nurma plant. The number of seeds yielded by the 855 grains of kuppas above, was, from the Nurma 765, from cross 703. Showing a difference in favor of the latter less by 62, and which it may be presumed gave place to the increased rate of wool. If the seeds of this plant retain the characters of their parent, then there can be little doubt that a valuable improvement has been obtained. Until these are sown next season, this point cannot be ascertained.

January, 1845.—Owing to the absence this season of the usual falls of dew, the month of January has not been favorable to the ripening of the cotton crop. The prevailing wind has been from the North-east, of a dry, cold, withering nature, contrasting strongly in its effects, with the moist, genial westerly winds, so very beneficial to the development of the tender bolls and blossoms of the cotton plant. It seems probable that, in general over the district, about one-eighth less, will be the effect on the out-turn of the crop, from this failure of dew.

2nd.—At the farm, the agricultural work of the month has been little. A few men employed in carting out manure, to spread on the land, for the next crop, and others in tending the cattle out at grass; in all, eight monthly hired servants. On the 23rd, the work of gathering in the crop commenced, as will be seen from the diary. In 1843, picking began 20th of January. In 1844, on the 1st of February. But this season the general bulk of the crop is more advanced than in the former seasons, particularly of the earliest sown parts, and which appear to have been forced on to maturity by the dryness of the season, there having been a failure both of the

latter rain, or in the two last months of the monsoon, September and October, and of the annual heavy dews of December and January. But however the cause of this may be, there is a decided superiority in the appearance as to vigour and fruitfulness of the latter sown part of the cotton fields, on black soil, distinguished from the seed which was sown towards the end of July and beginning of August, and this remark holds good in reference to all the crops of the Broach districts, which I have seen. The fact that such is the case, is deserving of notice, for it is generally believed here, that the earlier in the season cotton is sown the better the crop; and although in point of correctness it generally happens that such is the result, still in irregular season, such as the last year, when the great bulk of the rain falls at the beginning of the season, and destroys the early sown plants, the cultivator should not lose heart, as sometimes is the case, but re-sow in the confident hope that he may have a fair crop, though late, and requiring probably, some small amount of extra working, to bring it forward.

3rd.—On the 1st of the month I left Broach on a tour through a part of the cotton districts, visiting Gundar, Jumbosur, Baroda, Duboy, Chandode, Senhore, &c., in succession, and was absent 21 days. In all 72 villages were passed through, and 123 "koss" of road travelled over. It would be impossible here to detail an account of the various matters of importance that presented themselves to notice; my chief object in undertaking the tour was, to witness the nature and style of the cultivation, obtaining in the districts passed through: and at present I shall briefly notice only a few circumstances bearing upon the above object. It had been impressed upon my mind, I do not know exactly how, that the villages under the Baroda estate, presented generally a more flourishing aspect than those of the Broach Collectorate: but although at least half of those passed through belonged to the Guicquar, I saw no where any marks of superiority; on the contrary, it appeared to me that their general aspect, as well as that of their inhabitants was, if at all different, inferior in every important point,—the streets more filthy, the bulk of the houses mere hovels, and the people more miserable, and deficient in energy, seizing every opportunity to complain of their hard fate. I felt quite satisfied, from all I saw, that the cultivators

in the villages under English rule were the best off of the two. This is not saying much for our own villagers, but low in the scale of human advancement as they must rank, still I do not see how our own people could be improved, or placed in better circumstances, than they are in at present, unless by the introduction among them of instructors, or motives, to act on their minds, and lead them on the road of improvement. From the universal complaint, of their being "no profits remaining to the cultivator," it appears clear that the great fall in the value of produce which has taken place of late years, has been much felt. I found however that it was the best mode of reply to such complaints to say, that I would employ any good workman at my farm on a monthly salary of four rupees, if he would come and live at the steading. To at least fifty grumblers this proposal was made, without one accepting the offer. Hence I think there is at least some reason to doubt the entire truth of the complainants' statements. The natives here are however so attached to their villages and lands, that they would suffer much misery rather than give them up, or leave them, and the above, though a test to a certain extent, cannot be entirely relied on.

4th.—The system of culture in some of the Baroda villages, differs materially from that of Broach. Thus the land is sown or cultivated only one season, and during the next is laid fallow, one-half of the village land being alternately fallowed, and then next season cultivated. This is a very simple plan of farming, and good cotton no doubt is raised thereby. But by it the most is not made of the land, and where the soil is good the alternation of crop system might be practised, with only occasional fallowing to greater advantage in the shape of profit as in some of the Broach villages. But this is a superior style of tillage, and would require more laborers, more cattle, more energy, and more capital, than apparently, the villagers are able to command. The country referred to generally, appears far from being over-populous, and as to the bullocks used in agriculture, they are mostly very inferior in breed and over-worked by being under-fed. It appears to me that a great mistake is committed by many of the cultivators, even of our own villages, in over-working and under-feeding their cattle, taking more land than, with such cattle, they can properly cultivate. There would be the

reward of better crops by more care bestowed in ploughing, hoeing and weeding, but I presume the cultivator makes a larger profit by chances of the season, and trusting the return of produce more to that, than increase of labor bestowed. With bad cattle no good produce of any kind can be raised, and fields of cotton are always decidedly inferior both in the quality of the staple, as well as the quantity yielded, where ploughing and hoeing have not been properly given them.

5th.—In most of the Guicquar villages, the plan of renting the land differs from that of Broach. It is what is commonly called "Bhagdari," distinguished from the "Bigotia," lately, I believe, adopted in the Broach districts. When properly managed and worked, I prefer the Bhagdari plan to the other, but I am not sufficiently acquainted with the merits or demerits of either of them to be able to give a decided opinion. The Bigotia plan I think however expects more from the individual, or the renter of each small field, than can be realized, he is left too much to do as he pleases, and I fear will, from laziness, apathy, and other failings, be inclined often to delay, and neglect the work of his fields at the time when it should be done, and hence loss, or deficient returns of produce will result. The native cultivators of the soil I find, are exactly like big children, they are not to be trusted, but if well looked after will do the work required of them just as a school-boy learns his task. I say nothing of moral principles being brought into operation, for if the native has any, they are so small as to be of no avail. The headmen, or Bhagdars of a village having power to direct the work and proceedings of the villagers under them, must be of great avail; no doubt it may have been often liable to abuse, but when properly exercised, like the authority of the schoolmaster over his pupils, it must have been of essential service to the best interests of all parties.

February, 1845.—Last month's report had a few remarks on the failure of the usual dews of the season, and during February very little change for the better has happened. At the commencement of the month there were a few days on which westerly winds blew, and which were of great use in aiding the ripening and bursting of the

pods of cotton. Since the middle of the month, however, dry north-easterly wind has prevailed, the effects of which are to shrink and dry up the, as yet, unripened fruit of the plants, and thus diminish considerably the quantity of produce. The want of instruments for meteorological observations, prevents me giving any more exact details of the climate in my monthly reports, but could such be supplied, there is every probability that useful facts in regard to climate and its effects on vegetation and agriculture would be obtained. Experiment, by the sowing of seeds in any country, very soon shows whether the circumstances of climate are inimical or the reverse, but it is only after long experience that a sufficient practical knowledge of the various effects of climate, &c. can be understood and explained. From small experiments during a series of years I had satisfied myself by 1840, that there was very little chance of American cotton being raised in this country, nor did I fail to express this opinion. I could not however explain fully the causes that operated to prevent foreign cottons being cultivated. Since that time it has been demonstrated by large trials, that the effects of climate are the grand obstacles to the successful culture of American cotton in India. Its vicissitudes, or too sudden alterations from moisture to dryness, are destructive to the organization of the plant, first injuring the leaves, and through them the fruit or produce. Near Coimbatore, and in part of the Dharwar district, the former above and the latter below the extraordinary pass in the great western ghats, has any success as yet attended, I believe, the trials to grow American cotton in India; and the secret of the small success at those places, clearly depends on the well known fact, that through the opening in the ghats there, called Palgatcherry pass, both the monsoons affect the hygrometric state of the atmosphere, so as to admit of the plant growing without those sudden checks to which it is subjected, in other places not so circumstanced. At the same time that I put on record my opinion of the difficulties in the way of the culture of American cotton, I stated my belief that much might be done in the way of improving the indigenous cottons of India, and, as far as experiment has yet gone, I believe every thing is in favor of the preference which should be given by experimenters, in attempts at improvement of the indigenous

cottons; and this result appears to depend mainly, if not entirely, on the peculiar effects of climate.

2nd.—The usual diary of the work at Kokurwara shows what has been done there during the month—gathering in the crop, and transmitting it to the cotton gins has been the chief work; very considerable difficulty in obtaining people to pick the crop has been experienced, so much so, that I fear, from its not being gathered in time, it has sustained some injury. There is more dirt and leaf mixed with the cotton from the delay than would otherwise have been the case. Repeated application for assistance was made to the local authorities but with very little apparent effect—about one-third of the crop still remains to be gathered—what has already been brought in is very good (save from the injury above noticed) and the gins were set to work on Monday, the 24th February to clean it; a couple of small samples accompany this Report, that the qualities may be seen. The parcel marked No. I, has been prepared by the American gins. That marked No. II, by the common Broach churka, and they are fair samples of the crop of the whole farm, such as it will be when cleaned by those different machineries. Cotton, such as this, in my opinion, should be worth 4*d* per ℔. in Liverpool, even at the present reduced market rates; and at that price it would pay the cultivator here to grow it, if he had only a small reduction, I think, of his rent, and a few of the facilities necessary to any improved system of agriculture. That the cotton growers in America can raise produce equal to this, and find a remunerating price in 4*d* per ℔., I hope, for the sake of this country, will not be practicable for a long time to come. If they can do so, then I fear cotton culture in this country must gradually become a loosing trade. I have to regret the absence so long of the Engineer from Broach. I am left alone to look after the farm, and to trim the gin house machinery, all of which is more than I can well manage alone: sometimes I have to visit the farm twice a day, the difficulty of managing the people is such, and the danger of theft of the produce by them so unprovided against. If I had delayed the ginning of the cotton for Mr. Hall's return, it would have put off the work to an indefinite time, or an unfavorable period of the season,—as it is, however, I trust the cotton will be found to be as well ginned as it was last season, when I had the advantage of his assistance.

Note of samples.

No. I.—Cotton produced at Broach from native seed in season 1844-45, and prepared by the American cotton gins, 28th February 1845: a fair specimen of the produce from about 250 acres of land.

No. II.—The same produce as in the parcel No. I, but prepared by the common native churka, 28th February 1845. An opinion on the value and qualities of the samples is requested.

March, 1845.—March has been remarkable for the continuance of dry, hot, and ungenial weather, or rather, more correctly perhaps, for the commencement of this kind of weather about one month earlier than usual in the season of the year. There was almost no dew all the month, even the showers of rain usual at this season have not fallen; all this is the more to be noted as the newspaper reports notice unusual falls of rain in many parts of India during February and March.

2nd.—The principal work at the farm has been gathering in the cotton crop, carting it to the gin house, and looking to the proper stirring up of the fallow land. On the 5th, the picking of the kuppas was completed; last year this work was not over until the 27th of April, being a difference of 43 days in the season of harvest completion. The dryness of the latter part of the season has clearly been the canse of this. Last year payment was made for picking, in round numbers, 98 bhars of kuppas: this year for about 66 bhars. The diminished amount appears attributable to the failure of the dew at the time of ripening. The crop to all appearance would have been a heavier one than that of last season, but for the failure of the usual falls of dew. The actual difference of the two, however, though not much, can at present only be estimated; until the produce is weighed at the gin house, the exact amount cannot be stated. It is curious the effects of heat should be the agency for termination of the cotton crop in this country, while those of cold are the causes in America: the two most opposite agencies bringing to pass the same result.

3rd.—There has been hard work for the Superintendent all the month in managing the laborers and preventing the stealing of produce, besides in other things perhaps not necessary to detail.

April, 1845.—Nothing has happened unseasonable in the weather of April. It has been the hotest and dryest month of the year, as

usual. Up to the very last day of the month there has been no indication of change towards the monsoon phenomena, unless the steadier holding of the SW. wind.

2nd.—At the farm, the work of hoeing up cotton stalks and thorns, and clearing the surface for the harrow, was completed on the 22nd. It is intended this season to work the surface with the harrow, in preparation for the seed, to the exclusion almost entirely of the native bullock hoe. The harrow last year was found of great service, doing the work more thoroughly, and at the same time at a rate at least double of that, the hoe could be made to do. Most unfortunately, however, it is to be feared, the arrangements made for securing sufficient harrows will prove in a great measure fruitless. The securing a sufficient supply of "kirby" as fodder for the cattle, to last until the end of the monsoon, has been effected during the month: 18,075 "poolas" have been stocked, costing in gross, rupees 226 : 4 : 0. This is by far the best kind of fodder for cattle, particularly in the dry season, and for this reason, as well as the imperative necessity of having a rotation of crops, to get the most out of the soil at the least expenditure, ought to form part of the cultivation of every farm. As a trial of the effects of various kinds of manures cannot fail to be of value by the results it is calculated to afford, it is intended to employ lime on a few acres; also goats' dung on another portion, penning them at night. Large flocks of sheep and goats come into the plains at this season, and can be hired for a trifle to reside on any particular spot. A third plan is to sow the seeds of the *Crotalaria juncea* at the commencement of the rains, ploughing them down before sowing cotton, that they may act as manure in the same way as lupins are used in some of the Southern states of Europe. Already a considerable quantity of cattle shed manure has been carted out, and a flock of from 300 to 400 sheep and goats engaged, at a cost of four annas per diem and water to drink. The cultivators here are quite alive to the value of manure, but they rarely make use of it, saying they cannot afford to cart it to the fields. The use of goats' dung they more readily avail themselves of. Lime and green herbage manures they have no knowledge of whatever. It will also be necessary to lay a portion of land in fallow this season, where cotton has been raised for several years in

succession, as it now exhibits symptoms requiring change, such as getting full of weeds and yielding small cotton plants and diminished produce. The most weedy or dirty portion of the farm will be selected for fallow. The proportion and modifications which all these plans will ultimately assume, it is impossible at present to state, so much depends on the decision of Government in reference to the giving up of the land at Karode, and obtaining a portion in lieu of it at Kokurwara. Indeed, the delay in deciding such matters, completely paralyses all efforts at profitable farming; arrangements in proper time being of such consequence. By the delay, for example, the bullocks, their agricultural implements, the cattle sheds, &c. &c., at Karode are all thrown idle, when just now they should be employed in preparing land for next season's crop. This of course no skill, or system of agriculture, can stand the expense of, and yet the only test of success admitted, is made on the question of profit and loss.

3rd.—It has been found necessary during the month to bring charges before the Magistrate against the two head men at the farm, for stealing "kuppas" and cheating, or embezzlement of the pay due to the work people employed: the case has not yet been decided.

4th.—The whole of the cotton crop of this season has been prepared by the American gins, as by the reports received from Liverpool, the portion last year that was cleaned by the native churkas, for the sake of comparison, has been valued at $\frac{1}{4}d$ less per pound than the ginned produce. On the 9th April, 72 bales, containing net 27,486 lbs., were shipped from this to Bombay for transmission to Liverpool; by the last mail from London, information has reached this, that a Company is being arranged for the purpose of ginning cotton in this country, based on the success which has attended the experiments. This is very encouraging, and there can be no doubt of its success here if properly managed; but the difficulties it will have to contend with, judging from experience, are considerable; and unless under judicious and careful management, with liberal aid and good-will from the local authorities, it cannot be expected to have much success. That it would ultimately lead to the improvement of the country, by helping to increase the value of its cotton produce, or rather perhaps saving it from falling to the lowest scale of value in the European markets, there can also be little doubt.

May, 1845.—The month of May has been seasonable, hot and dry, with a powerful sun all day, but, to alleviate his excessive effects, replaced at night by a cool dewy breeze from the SW. Were it not for the cool nights, the continued heat would be destructive to the energies both of plants and animals.

2nd.—The work at the farm has been going forward briskly all the month. On finding it probable I should be deceived if I waited for the harrow ordered at Bombay, I had two made up here, which, with those made last year, enabled me to get on with the work; though from their defects (constant breakage of the teeth) it was at a great sacrifice, both of labor and money. The pair made at Bombay, arrived here only on the 1st Instant; so, if I had depended on their arrival entirely, the work of this season would have been too late; still it is not so good as I wished.

3rd.—Every thing is nearly quite ready, only waiting for the rain to enable us to begin sowing the seed. The fills, &c., required for the gin machinery, have arrived safe from Bombay, but as yet none of the cotton thrashers, or the rice husking machine, which is to be regretted, for if the Engineer leaves Broach in September next, there will be no artisan to put them up.

June, 1845.—It was fortunate that the work of the farm was advanced so far, as stated in last month's report, because the monsoon fairly commenced on the afternoon of the 6th Instant, and the rain has continued at intervals ever since that date. From the register of the Pluviometer attached to this report, it will be seen, there has fallen eight inches and eighty-one cents in all, up to the end of the month. The amount, as well as the distribution shown, is as favorable as could well be for the cotton farmers of this district, and they generally agree, that it bears a striking contrast to the two previous seasons. The rains, however, it is worth noting, began a fortnight earlier than the natives expected; most of the fields round Broach were unprepared for them. This of course must detract from the amount and value of the crops they yield in the coming season.

2nd.—The farm work of the month is minutely shown in the diary. Sowing the cotton seed was begun on the 18th and completed on the 24th (except the few acres of fallow land which was sown on the 11th.) The seed has been got into the soil in a superior style, com-

pared to any season it has yet been my fortune to have charge of the experiments, and at this date it is all up and looking very healthy. In the April report it was noticed, that various kinds of manures were intended to be tried, it appears worthy of remark, that on the spot where lime was spread, the young cotton plants are the finest on the whole farm. So if its ultimate results be as favorable as present appearances indicate, it will prove a manure of great value. Of the cross breed of cottons, noticed also in a former report of last year, there is a promising crop of young plants. Besides, several new kinds it is expected, will be obtained from seed that was crossed during last season, and which is now growing. The labor of the people and cattle has been very severe during the month, but not more so than is necessary at seed time in any country where agricultural work is systemized. It was necessary to expend much labor, as well as money, in laying out the land and working it into condition, during the two years past; now, however, the chief difficulties have been overcome, and the land presents so fine an appearance to the eye of the practical agriculturist, that some of the natives say, they can stand and look at it for hours together with the highest enjoyment. It is a rare thing to meet with so large a space as 500 beegas cleared of every tree, weed, or obstruction, and presenting the finest arable surface in one continuous space. When told to go and plough their fields and work them in the same way, the excuse of all the people is, "We cannot afford it, where are we to get the money?" or they ask, "Will this expensive system admit of any profit?" They know as well as I do, that under the present system of Government management of the land tax, there would be no profit to them. This is a question however on which it is not my province to enter. I have always considered the chief object of this farming experiment to be the ascertaining correctly, first of all—what can be done in the way of raising good cotton—when, if found possible to grow good cotton at a profit, means will be taken to induce the cultivators of these districts to adopt the system. The dormant productive resources of Guzerat are great, and if an ordinary amount of skill and capital were introduced into the province, there can be no doubt, that under average ability of management, the present revenues might, in a very few years, be doubled. It is hoped, the results of these experi-

ments ultimately will clearly show this. There is, however, one general remark in proof of this opinion, the truth of which every person can perceive. Guzerat has a very rich soil, and a dense population, yet the land is not half tilled. At the Mauritius or the West Indies, the soil is not superior to that of Broach, yet the inhabitants are being taken away from India to those places, for agricultural work, at a great expense. Why not employ them in their own country?—curious perversity! Is it not self-evident, all that is wanted to render Guzerat as rich as any province in the world, is good government, and a little of the skill and capital which England is now sending so profusely to other places.

July, 1845.—Up to the end of July, the season here has been as favorable for cotton culture as could be wished. The contrast between it and the two previous ones is as marked as possible in respect to the fall of rain, both in the quantity and distribution. In 1843 and 1844, there was too much rain during June and July: in the year 1845 it has been as near what could be desired as possible, and all that is wanted now, is a few inches fall of rain to fill up the tanks and soak the fallow lands. As the falls of rain have been so light and with intervals between of several days, there has been almost no interruption to the operations of tillage; eight days being the whole number on which the cattle could not be employed; whereas, last year in this month, half of it was idle time, owing to the excess of rain. The details in support of these remarks will be found in the monthly diary and meteorological registers.

2nd.—Over all the farm, the young cotton plants are most healthy, and advanced in growth. There are about 380 beegas. As it is quite impossible to sow cotton on the same land continuously year after year, and expect to have a remunerating crop, advantage was taken of the refusal of Government to grant 200 beegas in lieu of that given up at Karode, and all the remaining portion of the farm was laid down in fallow crops; about 160 beegas to be sown with "Tul and Toor" mixed, and fourteen beegas with a mixture of "Joari," "Toor," and "Mung" as a crop of fodder for the cattle. Still owing to the very favorable season, this large proportion of fallow, by which I hoped to fully occupy the time of the cattle and servants, will hardly be sufficient. Fortunately, an order for gin cleaned cotton from Messrs.

Remington and Co., has given us some little work to occupy the cattle in part, otherwise they must have been standing idle, and of course at a loss to the farmer. The quantity of land in acres per annum, which a pair of bullocks can work, varies of course, according to the different circumstances which bear upon it; when I began the farm at Kokurwara, the land was in such a wild "jungly" condition, it required more than all the cattle I now have to work it: but now, during the last two years, it has been brought into such superior order, that henceforth ten pairs in place of twenty, will be nearly enough cattle. To this it may be said, "well, sell off the excess of cattle and keep only enough to do the work." This will not answer, however, because as an establishment must be kept up of servants alike under both circumstances, the only limit to a farm that can be made with economy is to have it equal to what the establishment can manage. If there be less work than it can overtake, there must be loss of time, and therefore a proportionate diminution on the credit side of the balance sheet. I never felt so vexed at any thing during the whole time I have been here as the refusal of the 200 beegas, for it has been the source of much difficulty, and I fear it never will be my lot to have again so favorable a season as this has been, wherein to get it brought under culture, so as to show the profits of my system of culture. It was a blow to my hopes, such as I could have looked for from my bitterest enemy rather than from my best friends.

3rd.—From the diary it will be seen, that there has been work at the gin house since the 18th of the month. Mr. Hall has been occupied in constructing a model for a windmill, as sanctioned in Government letter No. 2036, of 6th May last.

August, 1845.—Whatever the ultimate result may happen to be up to this period, the weather of the season has been very favorable for cotton culture, and yet, although the season of heavy rain is over, the total fall of the three past months amounts to only 20 inches 42 cents, being less by 11 inches 14 cents, than fell last year up to this date. There are few things more curious than the fact, (noticed by me in a former report, and now hereby further confirmed) of the annual falls of rain at different places being so various in quantity; a few miles of distance seems enough to give such results. At Broach the annual fall may now, I think, be set down at half only of that at

Bombay. A knowledge of the annual average fall, and distribution of moisture of the different stations throughout India, could not fail to be of the greatest value, for this is the chief element in deciding what kind of vegetation or cultivation may be expected or attempted. Had I known the character of the climate of the cotton districts of America, as well as I now do, I should at once have been convinced of the impossibility of succeeding in any part of India with the American plant. It may grow, and doubtless does grow in certain places where the monsoon happen to approximate the atmosphere in some measure to that of the American districts, but it is *mere samples of good cotton* that can be produced there; the chief bulk of the produce being very inferior in quality. The seed of the Broach cotton plant, *when properly cultivated,* would, in all the cotton districts of Western India, I think, prove to be by far the most remunerative. I believe that in the Southern Marhatta country as well as in Candeish, that if the Broach seed were introduced, these places would yield as good a produce as the Broach district, and the rent of the land in place of being only *one Rupee per acre* as at Dharwar, might be approximated at least, to what I pay at Broach—*upwards* of *five Rupees.*

2nd.—In last month's report I noticed the effect of having got the land of the farm into good condition on the labor cattle lightening their work. It may be now also remarked, that the expenses of the farm promise to be lightened also, and as far as I can yet see, apparently from the same source. Of the four months, from May to August, the total expenses of the farm have been for 1843-44, 1844-45, 1845-46, as follows: Rupees 1,492—1,496—933, respectively, and I see no reason to doubt that the proportionate diminution of this year will hold good to the end of the season. But I am also of opinion, that should the farm be continued on during 1846-47, the expenses will continue to show still a progressive diminution, while the quantity and the value of its produce will further increase.

3rd.—The value of manure in the agriculture of this country has been strikingly demonstrated this season. The vigor with which the cotton plants are growing, where it was applied, is most striking. In some parts where the soil was completely exhausted, by repeated cotton crops having been taken from it, year after year, and where

nothing but changing the kind of crop, or laying it fallow, would have rendered it fit to yield cotton: cattle manure has enabled it to yield as fine a growth of young cotton plants as could be desired. The part of the farm where lime was applied, is not so promising now as at first appeared. Its future progress and changes will be carefully observed, for whatever be the present appearances, it is from the ultimate results or amount of produce, that the proof of benefit is to be deduced.

4th.—On the 30th, the sowing of the fallow land with oil seed "Tull," was commenced, and will be completed in a few days.

5th.—There has been no work at the gin house since the 6th of the month, having finished off seventy bhars of kuppas for Messrs. Remington's Agent, Byramshaw Dhunjebhoy. In reference to the gin house, it cannot but have been often remarked by Government, that it is the chief cause of expense here. It would be a great saving of unnecessary expenditure if the Umjeed Bagh were given up, and the gins erected at the cotton farm. I cannot help repeating this here, although I have formerly brought the subject before Government, for it appears to me of so great consequence. It is too, not so much on account of the needless expense attendant on the keeping the place of from three to four thousand Rupees a year, as that it renders it an impossible thing to show, by the actual accounts, that gin machinery is an improvement over the native machinery used in cleaning cotton. I would give up the Umjeed Bagh contract, and erect the gins at the farm, without the smallest fear of loss, but in the hope of great gain to the cause. The expense, (if done now, while Mr. Hall is here) could not exceed two years' rent as at present paid for the place. But if Mr. Hall's experience is not availed of, the expense will be, I think, much more.

6th.—A pleasing feature in the progress and success of our endeavours to show the improvable nature of the cotton staple of this place is, the fact that several of the natives have arranged, and subscribed a sum of money, to construct a place for ginning cotton. I had the honor of forwarding to Government, under date of 30th August, a statement of the plan, and I cannot doubt it will receive warm encouragement from the authorities, as being a commencement to improvement, which must be considered by every one as pregnant

with benefits, alike reciprocal in effects to the Government, and the people of this country.

October, 1845.—Hopes were entertained in last month's report, that the heat and dryness of the atmosphere during October would not be excessive, and their injurious effects have not been so severe as they might have proved. Though the dews have been scanty, the easterly winds were not so constant as usual, at one time great fears for the crops, and dread of famine were imminent, but the people now consider the chief danger as past. The Jowari grain sown in September, and from which the staple food of the people is derived, it is now generally expected, will not fail. Nevertheless there cannot fail to be great deficiency and loss from the defective nature of the monsoon. The failure in quantity was accompanied by a total failure of the latter rains in September. There was nothing even of the usual elephanta or usual concluding showers of the monsoon. From the annexed register of the Pluviometer it will be observed, that there is 23 inches 33 cents, recorded as the total rain of all the monsoon of 1845. That of 1844 having been 36 inches 89 cents, and which gives 13 inches 56 cents of difference—a loss of nearly one-third in the last season, as compared with the former one. We had no rain from after the 11th September in 1845, but in previous years, heavy showers are wont to happen, at least up to the end of that month.

2nd.—In respect to the out-turn of cotton from the farm, at present nothing can be said, we must wait the beneficial effects of the cold season on the now too scorched plants. The crop of oil seeds promises very fairly. I refer to the diary for any other information that may be necessary.

November, 1845.—I have nothing particular to say about the weather of November; it has been seasonable. The crops on the farm now indicate the injury suffered from the failure of the latter rains in September, much more distinctly than formerly. The crop of cotton will be ripe much earlier than is usual, owing to this cause; as also all the produce of the country. There has been no work at the farm all the month. I have been occupied with the machinery of the Saw Gin Company, and Mr. Hall has been at Bombay for

the same purpose, having left on the 6th of the month. The slow progress one is able to make is most distressing. Several applications on the subject of saw gins have been made to me, as well as to the collector of Broach, during the month by natives. They appear anxious to have them if they could be sure of the machinery being safe; many people are watching the progress of the Saw Gin Company. There is hardly a chance now, however, of its machinery being ready for work this season.

December, 1845.—The weather of December has been very pleasant and cold. There were several cloudy days towards the end of the month, but no rain. Cloudy weather, or rain at this season, is generally believed, by the people, to be very injurious to the cotton plants, as well as to other cultivable plants, particularly the "Toor," *Cytisus cajan*, by causing their blossoms to drop off, and although there is no doubt of the fact, it would require some time and examination to explain it.

2nd.—From the diary it will be seen, that the gathering of the cotton crop has begun. This is by far the earliest season I have met with. In 1842-43, picking began on the 20th January. In 1843-44, on the 1st February. In 1844-45, on the 23rd January, and now season 1845-46, on the 22nd December; and thus a difference of 40 days earlierness this season is shown over season 1843-44, which was the latest, and of 29 days over season 1842-43, which was the most favorable of all these four seasons. That the cause of the earlier ripening of the crops this season depends on the failure of the latter rains, there can, I think, be no room to doubt. The effect has been by drying them up and preventing their full and fair development, and thus necessitating the rapid maturation of whatever portion of their produce was sufficiently advanced at the time when the check to growth happened.

3rd.—All the month I have been anxiously expecting Mr. Hall from Bombay, with the object of getting the machinery of the Saw Gin Company put up, if possible, to be ready for work this season. The subscribers are most urgent for its completion, and blame me for the delay, little knowing the difficulties there are to overcome in business of this kind.

Meteorological Register at Broach for the month of June, 1844.

Pluviometer. Day. In.	Day. Ct.	Night. In.	Night. Ct.	Total. In.	Total. Ct.	Remarks.
..	..	..	..	..	..	
..	..	..	..	..	..	Cloudy morning, drops of rain at 8½.
..	..	..	..	..	..	Ditto ditto day fine.
..	..	..	..	..	..	Ditto evening warm, cloudy-like rain c. g.
..	70	..	..	..	70	Rain began gently this morning, 70 cents up to I.
..	..	..	..	..	..	
..	..	..	..	..	..	
..	..	..	..	..	..	
..	..	..	5	..	5	Slight shower early this morning.
..	20	..	..	..	20	
..	..	..	..	..	..	
..	..	..	..	..	..	Cloudy, warm morning, very little wind.
..	..	..	..	..	..	
..	..	..	..	..	..	
..	..	..	..	..	..	
..	..	..	..	..	..	
..	4	..	..	..	4	Great heat, little or no wind, sun very hot at 2: thunder, shower, slight.
..	..	2	51	2	51	Great heat, evening shower, thunder set rain from 12 to 5 A. M.
..	..	..	5	..	5	Cloudy all day.
..	4	..	5	..	9	Ditto ditto.
2	61	5	65	8	26	Rain nearly all day and night.
1	6	..	96	2	2	Morning dry, day heavy, night dropping rain.
..	42	..	18	..	60	Morning sunshine, after heavy thunder.
..	..	..	..	..	..	No rain, but cloudy all day.
..	..	..	..	..	..	Sunshine and cloudy.
..	..	..	..	..	..	Wind and clear.
..	..	..	..	..	..	Fine morning.
..	..	..	..	..	..	Fine morning, weather sultry.
..	..	..	..	..	..	Morning fine, midday cloudy a little.
..	20	..	80	1	..	Morning warm and cloudy, rain began at 2 P. M.
l, 5	27	10	25	15	52	

Meteorological Register at Broach for the month of July, 1844.

Date, July, 1844.	Pluviometer. Day. In.	Day. Ct.	Night. In.	Night. Ct.	Total. In.	Total. Ct.	Remarks.
1	..	63	..	8	..	71	Morning rainy, tending to clear.
2	..	48	..	6	..	54	Ditto cloudy and showery.
3	..	70	..	6	..	76	Ditto clear, and sunny after heavy rain.
4	..	..	..	..	..	..	Clouds and sunshine.
5	..	..	..	..	..	..	Fine morning, warm sun.
6	..	..	..	1	..	1	Ditto ditto.
7	..	..	..	1	..	1	Ditto ditto.
8	..	5	..	28	..	33	
9	..	..	..	..	..	..	Fine, with clouds.
10	..	..	..	11	..	11	
11	..	24	..	7	..	31	
12	..	5	..	..	..	5	
13	..	4	..	16	..	20	Cloudy all day.
14	..	91	..	21	1	12	Rain nearly all day and all night.
15	..	53	..	10	..	63	Morning wet, day rainy, night showery.
16	..	2	..	1	..	3	Fine morning, day cloudy, and sunshine by turns.
17	..	5	..	36	..	41	Morning cloudy and damp, afternoon rain, night rain.
18	..	50	1	50	2	..	Morning fine sunshine, afternoon rain, night heavy.
19	..	..	..	38	..	38	Ditto ditto, day sunshine, rain all night.
20	..	..	..	..	..	..	Ditto ditto cloudy.
21	..	10	..	3	..	13	Day fine, rain evening.
22	..	20	..	45	..	65	Ditto ditto, heavy shower at 2, night rain.
23	..	35	..	15	..	50	Morning rain, all day damp.
24	..	68	..	65	1	33	All day wet, and nearly all night.
25	..	75	..	25	1	..	Morning fine sunshine.
26	..	4	..	..	..	4	Ditto ditto.
27	..	1	..	7	..	8	Day sunshine and cloudy by turns.
28	..	2	..	1	..	3	Morning dull, day fine windy.
29	..	..	..	..	..	..	Ditto fine sunshine windy.
30	..	6	..	..	..	6	Ditto ditto, rain afternoon.
31	..	2	..	7	..	9	Ditto ditto but cloudy.
Total,	..	..	..	..	11	51	

No. of rainy days, twenty-six.

Meteorological Register at Broach for the month of August, 1844.

Pluviometer. Day. In.	Day. Ct.	Night. In.	Night. Ct.	Total. In.	Total. Ct.	Remarks.
..	2	..	3	..	5	Morning cloudy, showery afternoon & night.
..	1	..	1	..	2	Ditto dull, shower day time and at night.
..	..	..	..	..	..	Ditto fine sunshine.
..	..	..	1	..	1	Fine day, a passing shower.
..	3	..	14	..	17	Morning, day, passing showers.
..	6	..	9	..	15	Ditto cloudy, showers during day and night.
..	3	..	7	..	10	Ditto ditto.
..	7	..	5	..	12	Ditto rainy, evening wet.
..	4	..	..	..	4	Ditto fine sunshine.
..	..	..	3	..	3	Ditto ditto.
..	2	..	6	..	8	Ditto fine sunshine, evening cloudy as usual.
..	..	..	..	..	..	Fine morning, day dry but cloudy.
..	..	..	7	..	7	Ditto ditto, evening cloudy as usual.
..	76	1	17	1	93	Morning cloudy and wet, rain all night.
..	2	..	3	..	5	Ditto rainy.
..	1	..	4	..	5	Ditto cloudy and damp.
..	1	..	9	..	10	Ditto fine sunshine.
..	..	..	..	..	..	Ditto cloudy.
..	3	..	3	..	6	Sunshine.
..	..	..	..	..	..	Ditto.
..	..	..	..	..	..	Dry and sun powerful.
..	..	..	46	..	46	Ditto ditto heavy showers.
..	4	..	..	..	4	Morning fine.
..	..	..	2	..	2	Ditto ditto.
..	..	..	..	..	..	Ditto ditto.
..	2	..	85	..	87	Ditto ditto, evening cloudy.
..	..	..	..	..	..	Ditto sunshine.
..	..	..	..	..	..	Ditto day fine.
..	..	..	11	..	11	Ditto ditto.
..	..	..	..	..	..	Ditto ditto.
..	..	..	..	..	..	Ditto ditto.
1	17	3	36	4	53	

rainy days, twenty-one.

Meteorological Register at Broach for the month of September, 1844.

Date, Sept. 1844.	Pluviometer. Day. In.	Day. Ct.	Night. In.	Night. Ct.	Total. In.	Total. Ct.	Remarks.
1	..	..	..	..	..	..	Morning fine, midday warm, night calm.
2	..	11	..	7	..	18	Ditto ditto sunshine, at 8 A. M. heavy shower.
3	..	90	..	35	1	25	Ditto heavy rain afternoon and all night.
4	..	96	..	11	1	7	Ditto rainy all day, evening fair, all night rain.
5	..	10	..	..	..	10	Ditto wet, midday fine, night cloudy.
6	..	2	..	17	..	19	Ditto ditto, ditto cloudy and sunshine.
7	..	..	2	34	2	34	Ditto dull, day fine, night rainy.
8	..	1	..	..	..	1	Ditto ditto, ditto fine, ditto ditto.
9	..	..	..	..	..	..	Ditto fine sunshine, ditto ditto.
10	..	..	..	..	..	..	Ditto ditto, day fine clear heavy dew.
11	..	..	..	..	..	..	Ditto, ditto, ditto.
12	..	..	..	..	..	..	Ditto, ditto, ditto.
13	..	..	..	..	..	..	Ditto cloudy, day fine, night fine.
14	..	..	..	..	..	..	Ditto, ditto, ditto.
15	..	..	..	..	..	..	Fine sunshine, ditto, ditto.
16	..	..	..	..	..	..	Ditto, ditto, ditto.
17	..	..	..	..	..	..	Ditto, ditto, ditto.
18	..	..	..	..	..	..	Ditto, ditto, ditto.
19	..	..	..	7	..	7	Cloudy, rain, a shower, fine.
20	..	..	..	..	..	..	Morning fine, day fine, night fine.
21	..	..	..	..	..	..	Ditto, ditto, ditto.
22	..	20	..	..	..	20	Cloudy ditto, shower afternoon, ditto.
23	..	..	..	..	..	..	Cloudy ditto.
24	..	1	..	..	..	1	Fine, afternoon thunder and rain, night fine, heavy dew.
25	..	..	..	..	..	..	Fine, afternoon thunder.
26	..	..	..	..	..	..	Fine, day fine, night heavy dew.
27	..	..	..	..	..	..	Morning cloudy, day fine, ditto ditto.
28	..	..	..	..	..	..	Ditto, ditto, night cloudy.
29	..	..	..	..	..	..	Ditto, ditto, ditto.
30	..	..	..	..	..	..	Morning fine, evening thunder, night fine.
Total,	2	31	3	11	5	42	

Meteorological Register at Broach for the month of October, 1844.

Pluviometer. Day. In.	Day. Ct.	Night. In.	Night. Ct.	Total. In.	Total. Ct.	Remarks.
..	..	..	..	..	..	Morning fine sunshiue, evening fine, night clear.
..	..	..	..	..	..	Ditto ditto, wind easterly, dry night, no dew.
..	..	..	..	..	..	Fine and easterly dry, no dew.
..	..	..	..	..	..	Clear sky and hot sun, easterly wind, no dew.
..	..	..	..	..	..	Ditto, ditto, ditto.
..	..	..	..	..	..	Ditto, ditto, a litte dew.
..	..	..	..	..	..	Ditto, ditto, no dew.
..	..	..	..	..	..	Ditto, ditto, ditto.
..	..	..	..	..	..	Ditto, ditto, ditto.
..	..	..	..	..	..	Ditto, ditto, ditto.
..	..	..	..	..	..	Ditto, ditto, ditto.
..	..	..	..	..	..	Ditto, ditto, heavy dew.
..	..	..	..	..	..	Wind westerly, ditto, ditto.
..	..	..	..	..	..	Ditto, ditto, ditto.
..	..	..	..	..	..	Ditto, ditto, ditto.
..	..	..	..	..	..	Thick mist, ditto, ditto.
..	..	..	..	..	..	Ditto, ditto, ditto.
..	..	..	..	..	..	Clear, ditto, ditto.
..	..	..	..	..	..	Wind easterly, hot sun, little dew.
..	..	..	..	..	..	Ditto, ditto, very little dew.
..	..	..	..	..	..	Ditto, ditto, ditto.
..	..	..	..	..	..	Ditto, ditto, ditto.
..	..	..	..	..	..	Ditto, ditto, ditto.
..	..	..	..	..	..	Ditto, ditto, no dew.
..	..	..	..	..	..	Ditto, ditto, ditto.
..	..	..	..	..	..	Ditto, ditto, and very little dew.
..	..	..	..	..	..	Ditto, ditto, ditto.
..	..	..	..	..	..	Ditto, ditto, ditto.
..	..	..	..	..	..	Ditto, ditto, morning become cold.
..	..	..	..	..	..	Ditto, ditto, no dew.
..	..	..	..	..	..	Ditto, ditto, ditto.

Meteorological Register of the Weather at Broach, the Season 1844, by Pluviometer at the Office of the Superintendent of Cotton Experiments.

Pluviometer. Months.	Rain fall in each month. Inch.	Rain fall in each month. Cent.	Date of fall of rain.	Number of days on which rain fell.	Remarks. Days on which rain fell.
June, 1844,	15	52	5th-30th	11	5, 9, 12, 17, 18, 19, 20, 21, 22, 23, 30.
July, ,,	11	51	1st-31st	26	1, 2, 3, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 22, 23, 24, 25, 26, 27, 28, 30, 31.
August, ,,	4	53	1st-29th	21	1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 19, 22, 23, 24, 26, 29.
Sept. ,,	5	42	2nd-24th	10	2, 3, 4, 5, 6, 7, 8, 19, 22, 24.
October, ,,	..	..	..	..	
Total,	36	98	..	68	

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Months.	Rain fail in 1843. Inch.	Rain fail in 1843. Cent.	Rain fall in 1844. Inch.	Rain fall in 1844. Cent.	Total. Inch.	Total. Cent.	Average. Inch.	Average. Cent.	Number of rainy days. 1843.	Number of rainy days. 1844.
June,	5	38	15	52	20	90	10	45	3	11
July, ...	13	84	11	51	25	35	12	67½	22	26
August,	14	57½	4	53	19	10½	9	55¼	22	21
Septembe	5	71	5	42	11	13	5	56½	21	10
October,	..	15	..	..	..	15	..	7½	3	..
Total	39	65½	36	98	76	63½	38	31¾	71	68

Meteorological Register at Broach for the month of June, 1845.

Pluviometer. Day. In.	Day. Ct.	Night. In.	Night. Ct.	Total. In.	Total. Ct.	Remarks.
..	..	..	..	..	..	Sunshine and very hot.
..	..	..	..	..	..	Ditto ditto.
..	..	..	..	..	..	Moroing cloudy.
..	..	..	..	..	..	Ditto ditto.
..	..	..	..	..	..	Ditto ditto.
1	58	..	..	1	58	Ditto ditto, but not like raio, heavy thunder shower at 4 P. M. the setting in of the monsoon.
..	36	1	79	2	15	
1	2	..	..	1	2	
..	5	..	..	..	5	
..	8	..	..	..	8	Showers at night.
..	..	..	..	..	..	Dry, with clouds and suoshine.
..	..	..	..	..	..	Sun and clouds all day.
..	..	..	..	..	..	Sunshine and cloudy all day.
..	..	..	74	..	74	About 3 A. M. a heavy thunder storm.
..	..	..	..	..	..	Morniug calm and cloudy, day cloudy.
..	..	..	..	..	..	Ditto cloudy, day cloudy.
..	21	..	..	..	21	Ditto, ditto, rain at 11 till 1.
..	2	..	..	..	2	Ditto 6oe, afternoon cloudy, night fine.
..	5	..	6	..	11	Ditto cloudy. ditto, ditto.
..	3	..	30	..	33	Ditto fine, after showery, night rain.
..	27	..	50	..	77	Ditto cloudy, ditto, ditto.
..	75	..	6	..	81	Ditto rainy, ditto, cloudy and damp.
..	..	..	..	..	..	Ditto cloudy and damp.
..	..	..	5	..	5	Ditto ditto.
..	..	..	4	..	4	Sunshioe, clear. ditto.
..	10	..	24	..	34	Ditto and showers, ditto.
..	..	..	11	..	11	Ditto, ditto.
..	..	..	20	..	20	Ditto, ditto.
..	..	..	2	..	2	Cloudy aod sunshine.
..	16	..	2	..	18	Ditto showery.
4	68	4	13	8	81	A very favorable season for agricultural work.

Meteorological Register at Broach, for the month of July, 1845.

Date, July, 1845.	Pluviometer. Day. In.	Day. Ct.	Night. In.	Night. Ct.	Total, In.	Total, Ct.	Remarks.
1	..	..	..	..	..	..	Day 6ne sunshine, night fine dry.
2	..	..	..	..	..	..	Ditto, ditto, ditto.
3	..	..	..	..	..	..	Ditto, ditto, ditto wiody.
4n.m	..	..	..	2	..	2	Ditto, ditto, shower, windy.
5	..	..	..	..	..	..	Ditto windy, strong wind.
6	..	..	..	1	..	1	Ditto, ditto. ditto.
7	..	3	..	..	..	3	Slight clouds and shower, at 11 windy.
8	..	..	..	..	..	..	Fine sunshine, threateniog rain, windy.
9	..	..	..	64	..	64	Cloudy, but windy, heavy shower at 3.
10	..	..	..	..	..	..	Ditto and calm, strong wind.
11	..	5	..	..	..	5	Ditto, rain at 2 P. M. calm and cloudy.
12 f. q.	..	25	..	7	..	32	Ditto. ditto, ditto.
13	..	11	..	70	..	81	Ditto and rainy, ditto and rainy.
14	1	3	1	14	2	17	Morniog rainy, afternoon clear, ditto.
15	..	26	..	9	..	35	Ditto cloudy and calm, ditto, ditto.
16	..	5	..	16	..	21	Ditto, cloudy, ditto.
17	..	..	..	..	..	..	Ditto, ditto. cloudy
18	..	..	..	2	..	2	Ditto, ditto, ditto.
19 f.m.	..	..	..	..	..	..	Cloudy and a little wind, ditto.
20	..	..	..	..	..	..	Ditto, clear, ditto.
21	..	..	..	..	..	..	Morning sunshine, ditto, ditto.
22	..	..	..	..	..	..	Ditto cloudy, ditto. ditto.
23	..	2	..	1	..	3	Sunshine, ditto. ditto.
24	..	3	..	..	..	3	Cloudy, cloudy, ditto.
25	..	..	..	..	..	..	Sunshioe, ditto, ditto.
26 l. q.	..	3	..	1	..	4	Ditto, ditto, ditto.
27	..	..	..	3	.	3	Ditto, ditto, ditto,
28	..	2	..	8	..	10	Cloudy, clear, shower.
29	..	..	..	25	..	25	Sunshine, ditto, ditto.
30	..	17	..	15	..	32	Cloudy, showery, raining.
31	..	9	..	10	..	19	Raining, ditto, ditto.
Total,	2	14	3	48	5	62	This month has been very favorable for cotton agriculture.

Pluviometer. Day In.	Day Ct.	Night In.	Night Ct.	Total In.	Total Ct.	Remarks. Morning.	Day.	Night.
..	3	..	..	..	3	Cloudy,	Showery,	Clear.
..	2	..	..	..	2	Ditto,	Ditto,	Ditto.
..	..	..	10	..	10	Ditto,	Clear,	Ditto.
..	..	..	25	..	25	Sunshine,	Cloudy,	Rainy.
..	..	..	2	..	2	Cloudy,	Ditto,	Cloudy.
..	1	..	4	..	5	Ditto,	Sunshine,	Ditto.
..	..	..	10	..	10	Ditto,	Ditto,	Ditto.
..	..	..	80	..	80	Ditto,	Ditto,	Cloudy rain.
..	25	..	5	..	30	Rainy,	Ditto,	Cloudy.
..	..	1	1	1	1	Clear,	Ditto,	Raioy.
..	54	..	28	..	82	Rainy,	Rainy,	Ditto.
..	2	..	..	..	2	Cloudy,	Cloudy,	Cloudy.
..	2	..	23	..	25	Ditto,	Ditto,	Showery.
..	..	..	3	..	3	Ditto.	Sunshine and cloudy,	Ditto.
..	..	..	..	..	..	Ditto.	Ditto,	Clear.
..	..	..	..	..	..	Sunshine,	Ditto,	Ditto.
..	..	..	..	..	..	Ditto,	Ditto,	Ditto.
..	8	..	..	..	8	Showery,	Ditto,	Ditto.
..	..	..	..	..	..	Sunshine,	Sunshine,	Ditto.
..	15	..	2	..	17	Ditto,	Rainy,	Cloudy.
..	2	..	..	..	2	Cloudy,	Cloudy & sun.	Ditto.
..	..	..	8	..	8	Cloudy,	Ditto,	A shower.
1	16	..	28	1	44	Rainy,	Rainy all day,	Rainy.
..	4	..	..	..	4	Cloudy.	Cloudy & sun.	Cloudy.
..	28	..	..	..	28	Do. & shower,	Sunshine,	Clear.
..	8	..	..	..	8	Showery.	Ditto,	Ditto,
..	29	..	10	..	39	Ditto,	Sunshine and showers,	Cloudy.
..	..	..	..	..	..	Sunshine,	Clear,	Clear.
..	..	..	..	..	..	Ditto,	Ditto,	Ditto.
..	..	..	..	..	..	Ditto,	Ditto,	Ditto.
..	1	..	..	..	1	Ditto,	Sun. & cloudy,	Clear.
3	..	3	39	6	39	Very favorable season for Cotton culture.		

Date, Oct. 1845.	Pluviometer. Day In.	Day Ct.	Night In.	Night Ct.	Total In.	Total Ct.	Remarks. Morning.	Day.	Night.
1 n. m.	..	..	..	..	..	..	A thick mist till 10 o'clock,	Hot sun,	Clear & cool.
2	..	..	..	..	..	..	Clear,	Do. wind SE.	Ditto.
3	..	..	..	..	..	..	Ditto,	Ditto.	Ditto.
4	..	..	..	..	..	..	Mist,	Do. E. wind,	Do. E. wind.
5	..	..	..	..	..	..	Cloudy,	Ditto,	Ditto.
6	..	..	..	..	..	..	Clear,	Do. Thr. in shade 100,	Ditto.
7	..	..	..	..	..	..	Clear and hot,	Do. Thr. up to 100,	Ditto. [cool
8 f. q.	..	..	..	..	..	..	Ditto,	Ditto.	Wd. westerly,
9	..	..	..	..	..	..	Ditto,	Hot E. wind,	Do. cool and damp. [dry.
10	..	..	..	..	..	..	Ditto,	Do. very hot,	Do. easterly,
11	..	..	..	..	..	..	Ditto,	Ditto,	Ditto.
12	..	..	..	..	..	..	Ditto,.	Clouds wd. E.	Ditto.
13	..	..	..	..	..	..	Ditto,	Ditto.	Do. E. by S.
14	..	..	..	..	..	..	Wd. easterly,	Clear wind E.	Ditto east.
15 f. m.	..	..	..	..	..	..	Ditto,	Ditto.	Ditto.
16	..	..	..	..	..	..	Cold mg. wet,	Ditto,	Ditto.
17	..	..	..	..	..	..	Do. wind east,	Ditto,	Ditto.
18	..	..	..	..	..	..	Ditto,	Ditto,	Ditto.
19	..	..	..	..	..	..	Ditto,	Ditto,	Ditto.
20	..	..	..	..	..	..	Ditto,	Ditto,	Do. westerly.
21	..	..	..	..	..	..	Wd. changing	Ditto,	Do. [dew.
22	..	..	..	..	..	..	Ditto,	Ditto,	Do. a little
23 l. q.	..	..	..	..	..	..	Do. E by S.	Ditto,	Ditto.
24	..	..	..	..	..	..	Do. cold increasing,	Ditto,	Ditto.
25	..	..	..	..	..	..	Ditto,	Wd. westerly,	Ditto.
26	..	..	..	..	..	..	Ditto,	Ditto,	Ditto.
27	..	..	..	..	..	..	Ditto,	Ditto,	Ditto.
28	..	..	..	..	..	..	Ditto,	Ditto,	Do. variable.
29	..	..	..	..	..	..	Ditto,	Ditto,	Do. no dew.
30	..	..	..	..	..	..	Ditto,	Ditto,	Ditto.
31	..	..	..	..	..	..	Ditto,	Ditto,	Ditto.
Total.	..	..	..	..	..	..	Crops suffering much from drought.		

Meteorological Register of the Weather at Broach, for the Seasons 1843, 1844 *and* 1845, *by Pluviometer, at the Office of the Superintendent of Cotton Experiments.*

Pluviometer. Months and Years.	Rain fall in each Month. In.	Ct.	Date of falls of rain.	Number of days on which rain fell.	Remarks.
1843.					
June, ...	5	38	3rd to 23rd.	3	
July, ...	13	84	2nd to 31st.	22	
August, ...	4	57½	1st to 31st.	22	
September, ..	5	71	1st to 28th.	21	
October, ...	..	15	1st to 5th.	3	
Total,..	39	65½	.. ..	71	
1844.					
June, ...	15	52	5th to 30th.	11	
July, ...	11	51	1st to 31st.	26	
August, ...	4	53	1st to 29th.	21	
September,..	5	42	2nd to 24th.	10	
October, ...	..	..	.. ..	..	
Total, ..	36	89	.. ..	68	
1845.					
June, ...	8	81	6th to 30th.	19	
July, ...	5	62	4th to 31st.	19	
August, ...	6	39	1st to 31st.	24	
September,..	2	51	4th to 11th.	5	
October, ...	..	..	.. ..	..	
Total, ..	23	33	.. ..	67	

In 1843 the crops of cotton suffered from excess of moisture.

In 1845 the crops suffered from deficiency.

The average fall of the three seasons is 33·29.

The deficiency of 1845, or less amount than 1844, is 13·56, nearly ⅓.

Reports on the Sale of Assam Teas in London during February and March, 1846. Communicated by the Government of Bengal.

To the Honorary Secretary, Agricultural and Horticultural Society.

Revenue. SIR,—I am directed to forward copy of a Dispatch from the Honorable Court of Directors, No. 4, dated the 6th ultimo, together with the Reports on the results of the sale of Assam Teas referred to therein, for the information of the Society, and for publication in their Journal, if thought suited for that purpose.

I have, &c.

Fort William: CECIL BEADON,
24th June, 1846. *Under-Secy. to the Govt. of Bengal.*

REVENUE DEPARTMENT.

No. 4 of 1846.

Our Governor of the Presidency of Fort William in Bengal.

Para. 1.—We received the packages of Assam Tea forwarded by you per Ships 'Emily' and 'Himalaya' respectively, from which we caused a liberal distribution to be made. The remaining packages were sold by public auction, and we now transmit you the results of the sale, together with the reports of Mr. Thompson and Mr. Andrew Hunt, on the character and quality of these consignments, which may be useful if published for the information of those engaged in the cultivation of the plant in Assam.

Bengal Secy.'s letter, 7th May, 1845.
Ditto 10th Sept., 1845.

17th March, 1846.
28th February, 1846.
14th March, 1846.
24th March, 1846.

2nd.—Our instructions for discontinuing the further cultivation and manufacture of Tea on the part of Government, were contained in our Dispatch dated 4th February, (No. 2,) 1846.

We are, &c.

London: (Signed) J. W. HOGG,
6th May, 1846. „ H. ST. G. TUCKER, and
13 other Directors.

Account Sale by MESSRS. W. J. THOMPSON AND SONS, *17th March,* 1846.—*Assam Tea. At Cutler Street, Top Floor.*

CAMPOI.

Per 'Emily,' ANDERSON, *from Calcutta. Reported January,* 1846.

Br. 1. 15 chests.

Lot 1 Nos. 1 to 7 . . . . . 7 chests sold to Carlisle & Co., . @ 2½*d.* per lb.
„ 2 „ 8 . . . . . 1 „ . . . . . . „ . . . . „ . . „
„ 3 „ 14 & 15 . . . . . 2 „ . . . . . . „ . . . . „ . . „
„ 4 „ 16 to 20 . . . . . 5 „ . . . . . . „ . . . . „ . . „

CONGOU.

Br. 1. 5 chests.

Lot 5 Nos. 9 to 13 . . . . . 5 chests sold to Parker & Co., . . @ 11*d.* per lb.

PEKOE.

Br. 1. 15 chests. *s. d.*

Lot 6 Nos. 21, 22, 24 to 28 7 chests sold to Styan & Co., . . @ 1 4 per lb.
„ 7 „ 29 to 31 . . . . . 3 „ . . . . . . „ . . . . 1 2½ „
„ 8 „ 32 to 36 . . . . . 5 „ . . . . . . „ . . . . „ „

SORTS.

1 case containing 12 canisters.

Lot 8* No. 37 . . . . 1 case sold to Hulbert & Co., . . @ 8*d.* per lb.

At Cutler Street, D. *Top Floor.*

CAMPOI.

Per 'Himalaya,' BURN, *from Calcutta. Reported January,* 1846.

Br. 1. 9 chests.

Lot 9 Nos. 1 to 6 . . . . . . 6 chests sold to Charlesworth, . . @ 5*d.* per lb.
„ 10 „ 7 & 8 . . . . . . 2 „ . . . . „ . . . . 3¼*d.* „
„ 11 „ 35 . . . . 1 „ . . . . „ . . . . „ „

PEKOE.

Br. 1. 24 chests. *s. d.*

Lot 12 Nos. 9 to 16 . . . . . . 8 chests sold to Parker & Co., @ 1 4½ per lb.
„ 13 „ 17, 20, 21 to 25, 27, 28 9 „ . . . . . . „ . . . . 1 6 „
„ 14 „ 29 . . . . 1 „ . . . . . . „ . . . . 1 4¼ „
„ 15 „ 30 to 34, 36 . . . 6 „ sold to Ewart & Co., @ 1 3¼ „

SORTS.

Lot 16 Nos. 38, 39 . . 2 cases containing 12 canisters each, } Clearing for Mr. Greene's order.

To O. Greene, Esq.

Sir,—We beg to hand you a Report upon the East India Company's Tea, Ex 'Emily.'

				Leaf.	Flavor:	General remarks.
Nos.	396/7	2 hf. ch.	Campoi,	coarse curled brownish,	fair coarse burnt,	not sufficiently made and too brown.
„	474/8	5 boxes,	„	coarse brown,	faint caper flavor,	ditto.
„	495/9	5 hf. ch.	„	coarse blackish, rather broken and mixed brown	fair coarse burnt,	fair.
„	526/9	4 ch.	Congou,	coarse curled brown, mixed,	fair,	too brown and not sufficiently made.
„	531	1 hf. ch.	„	coarse brown and black leaf mixed,	coarse burnt good,	ditto.
„	539/40	2 ch.	„	preferable,	coarse burnt,	ditto.
„	551	1 ch.	„	ordinary small dull brown,	musty,	low.
„	514/19	6 ch.	Pekoe,	coarse brownish black Souchong kind,	good strong burnt,	good Souchong kind of Tea.
„	521/25	2 ch. 1 hf. ch. 2 boxes,	„	preferable,	very good,	fine ditto.
„	544/46	3 packages,	„	brownish blackish leaf Souchong kind,	fair,	leaf good but flavor inferior.
„	548/49	2 boxes,	„	good curled blackish,	good,	Pekoe Souchong kind.
„	541	1 box, containing musters.				

London: We remain, &c.

28th February, 1846. (Signed) W. J. Thompson and Sons.

To O. Greene, Esq.

Sir,—We beg to hand you a Report upon the East India Company's Tea, Ex 'Himalaya.'

				Leaf.	Flavor.
Nos.	1 to 8 35	9 ch.	Campoi,	coarse curled brown, caper kind.	little burnt.
„	9 to 34 36	24 ch.	Pekoe,	wiry blackish, with some coarse brown mixed,	high malty burnt.
„	38, 39	2 cases, containing musters.			

London: We remain, &c.

14th March, 1846. (Signed) W. J. Thompson and Sons.

Quality of the Assam Tea Imported by the East India Company in the 'Emily' and 'Himalaya.'

Congou.

Appearance.—Brown, curled knobby leaf, unsightly.

Smell.—Too fresh, rather sickly, some coarse and out of condition.

Taste.—Very similar to the most inferior Congou formerly imported by the Company from China.

Campoi.

Appearance.—Blackish wiry leaf; in all respects as the Chinese Congou Tea.

Smell.—As China Tea, but rather flat.

Taste.—As course and strong China Congou.

Pekoe.

Appearance.—Blackish, curled leaf, some having the down as in China Pekoe.

Smell.—Very little or no fragrance, rather worty.

Taste.—Good and strong, like the China Hong Muey Pekoe.

It is certainly of as much importance that the eye should be pleased by the appearance of the Tea as that the taste should be gratified by its flavor; the Chinese indeed would seem to think it of the first importance, for unsightly leaves are unknown in the article from China, but in the Congou Tea from Assam, the objectionable leaves *even* predominate, and would forbid, under any circumstances, its favorable reception in this market; such however is not the case in the Campoi and Pekoe, both kinds are as well and carefully made as China Tea, and the flavor, while it partakes in some measure of the fragrance of the China Tea, maintains the strength, which makes Assam Tea so useful in this market for mixing with weak flavored China Tea.

(Signed) Wm. Andrew Hunt,
Late Inspector of Tea to the East India Company.

24th March, 1846.

Suggestions towards an effective and economical mode of divesting Cotton of its seed. By C. B. Taylor, Esq.

To James Hume, Esq., *Honorary Secretary, Agricultural and Horticultural Society: Calcutta.*

My dear Sir,—I have been endeavoring for upwards of a year past to make a machine for separating cotton from its seeds, and which would perform the operation more economically than the 'chirkee.' By this ineffective machine it costs at the least one rupee and eight annas per bazaar maund to separate the cotton from the seed, and it is, I believe, considered an object of general importance to obtain a machine that would as effectually, and at a more moderate cost, perform the same operation. I have proposed two (see sketches 1 and 2), but whether either will answer remains to be tried, as I have failed to make the roller machine after three or four attempts during the past sixteen months; my blacksmiths could not make the steel roller exactly round, this in fact must be done in a *lathe* which I do not possess; they also found it impossible to make the teeth of the large cog-wheel fit exactly into those of the small one at the end of the middle steel roller. I am therefore obliged to give up any farther attempt, and to send you a drawing and description of the machine, instead of a model which I at first intended.

Before describing the two machines proposed by myself, I will notice a few others now in use. Little need be said about the saw-gin, for any one who will take the trouble to examine into its method of operating, will perceive that *it must* break the fibres of the cotton, although this has been denied lately.

There is another machine for clearing cotton of its seed, and which I believe has never been used in this country, and as it appears much better than our 'chirkee,' I copy on a detached piece of paper the description and drawing of it from "Nicholson's operative Mechanic," pages 378 and 379.

It is unnecessary for me to make any lengthened remarks about this gin, which although preferable to the 'chirkee,' is not one likely to prove completely satisfactory to the cotton growers of this country: none I suspect but a poor negro slave could be compelled to undergo such hard labor, as it would seem to require to clear of its seed 30 to 40 pounds of cotton per day.

I have endeavored to apply the power of bullocks to such a machine, as Nicholson has described; a better method might doubtless be contrived than that of mine, but I choose it because I think it would prove the most easily managed in practice. I have substituted three steel rollers for two wooden ones, (see Plate I.) as I am afraid that wooden ones could not be made of such a small size, three quarters to one inch in diameter, to bear the power of bullocks; the wheels must be placed parallel like those on the 'chirkee,' about the 20th part of an inch from one another; on the large cog-wheel attached to the upright iron spindle, there are seventy-two teeth, and twelve on the small one at the end of the middle roller, so that the rollers will perform six revolutions during the time it takes the bullocks to go once round the machine; the speed of the rollers may be accelerated by increasing the number of teeth in the large cog-wheel; both wheels ought to be bevelled.

I have put three iron rollers to the machine, but am not certain that more than two will be found of use in practice; the two upper rollers will move in different directions, and therefore a woman might be engaged at both sides feeding the rollers, and as there would be no want of power, could clear double the quantity of cotton of its seed in the same time that two rollers would; this would however be liable to the disadvantage of the seeds on both sides of the machine falling amongst the cleaned cotton, if the latter were not quickly removed, but as the seeds would only be lying lightly, they might be easily shaken off by the hand.

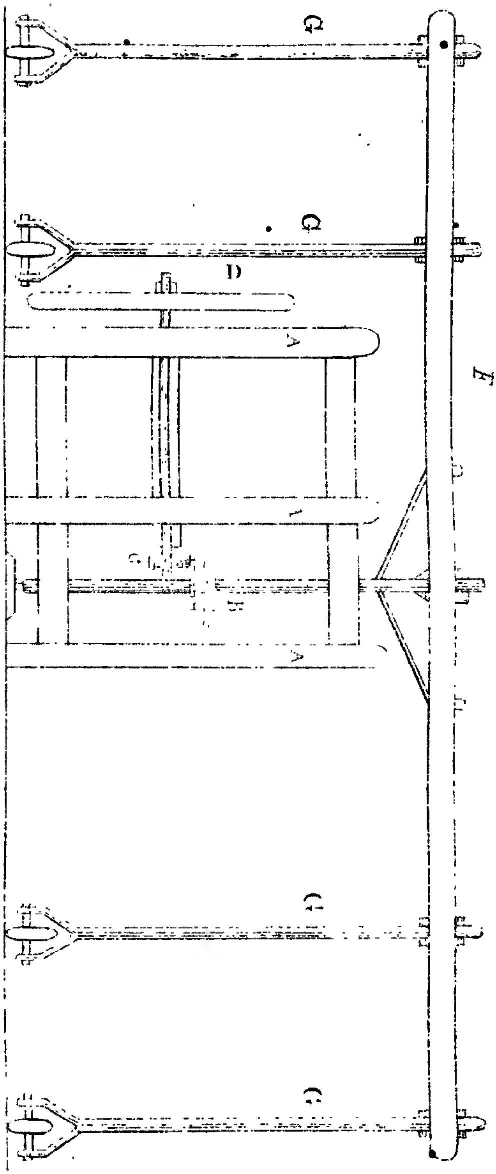
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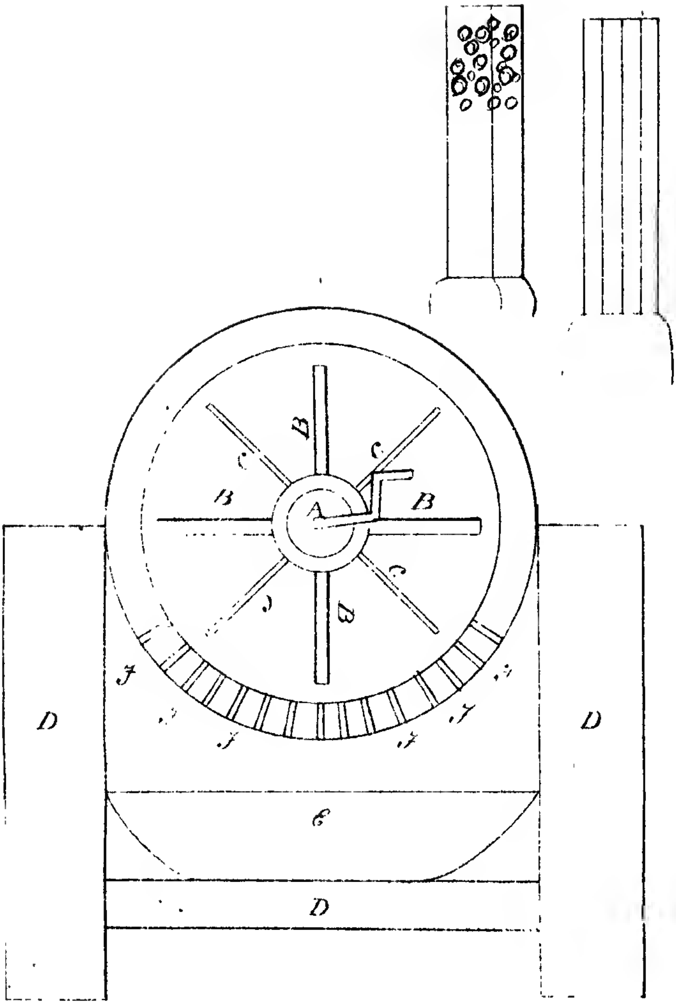
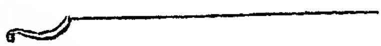
Plate II.



The other machine, (see Plate II.) with which I propose to clear cotton of its seed, is a circular box, the inside of which to be fitted with apparatus something similar to that of a fan-blast, but instead of being constructed so as to yield a volume of air only, the vanes of the fan would be made to beat the cotton also. I think that were eight vanes or beaters fixed into the centrepiece or nave, and the beaters made to perform the same number of revolutions per minute as the vanes of a fan-blast, that they would loosen the flocks or pods of cotton, and would tend greatly to separate the cotton from the seeds.

The bottom part of the machine would need to be perforated with holes sufficiently large to allow the escape of two seeds at a time, and which would fall through as soon as they became disengaged from the cotton; I have marked the places on the machine where I think the holes ought to be made.

The vanes or beaters I propose to make of two different descriptions, one of wood, with holes in the outer part, as shewn in the sketch, and the other composed of thin iron bars of sufficient strength, to overcome the resistance of the air, fixed in the nave the same as the wooden ones, thus,



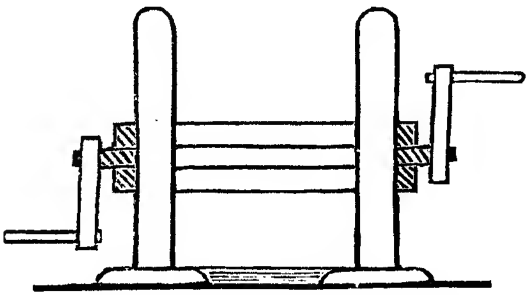
This contrivance would, I think, also greatly facilitate the separation of the cotton from the seed, as the velocity of the vanes would be so great, six hundred revolutions per minute at the least, that the cotton might be forced through the bars, and which would arrest the progress of the seeds, the bars being so adjusted that a seed would not be likely to pass through them.

There would also need to be a piece of cord, or wire run round the circumference of the vanes or beaters, about half an inch apart, to confine the cotton between the vanes whilst in motion.

Whether the machines proposed by me will answer the purpose intended or not, it is certain that some such machine is much wanted, as any such improved machine would effect a saving to the cultivators, consumers, or purchasers of cotton in this country, of at least 1,000 or 1,200 rupees per 1,000 maunds, and at the same rate for smaller quantities.

I am told that there is "a chirkee" in use in some parts of Hindostan with two handles, and at which two women work at the same time, it is also said that it will clear more cotton of its seed in one day, than can be accomplished by one woman at a "chirkee" with one handle.

Double Chirkee.

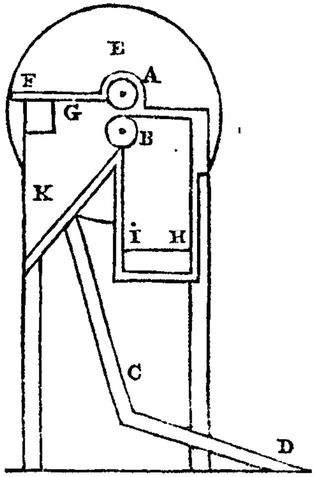


I have put three rollers to it, as it will certainly be more convenient for each woman engaged in working the machine to have a side to herself, and to be able to turn round the machine with her right hand, and to supply the rollers with her left.

There must be a door at the bottom part in the side of the circular gin, to admit of the cotton being put between the vanes and taken out when cleaned. I should propose to have the vanes or beaters placed within half or one inch of the circumference, and sides of the circular box.

Rajharrah Colliery, Palamow: I remain, &c.
18*th May*, 1846. C. B. Taylor.

[*From Nicholson's Operative Mechanic.*]



The roller-gin is represented in fig. 399. It consists of two shallow fluted rollers, A and B, placed so near to each other, that when the cotton is thrust against the line when they enter into contact, they immediately seize hold of it and draw it in between them, while the seeds and other particles not being able to pass through, fall into the box K, and are, by the slanting direction of its bottom, delivered on one side. The motion is communicated by means of the treadle and crank C, D, and is equalized by the fly-wheel E. The cotton is presented to the rollers over the board F, G, and is drawn between them, and delivered at I, H. In South America this kind of gin is much used, and a negro working with one of them can clean from 30 to 40 lbs. weight of cotton per day, which, however, is considered heavy work.

The application of the power of horses to either the roller or saw-gin, would greatly aid the process, which as we before have stated, is considered heavy work for the negroes, and on that account is much avoided; an objection has been started to the applying of this power, under a supposition, that the animal by changing his speed would injure the cotton; it is almost superfluous to add that many simple contrivances may be adopted to equalize the motion, and prevent these dreaded effects.

My dear Sir,—In reading an article relating to cotton since I wrote you on the 18th instant, I have found some further information respecting the method adopted in clearing cotton of its seed in North and South America, and beg to send you an extract from the article alluded to. I think you will agree with me in the opinion, that the gin used in the United States, and which it is stated in the account can clear 900 ℔ of cotton of its seed per day, is the one that is most likely to prove acceptable in this country, and I regret that there is no drawing of it, but I suppose to clear such a large quantity of cotton of its seed, steam power must be applied to the machine.

I also beg to give you an extract from the same work, describing a machine recently invented in the United States, for clearing the cotton seed of the fibres which adhere to it, and rendering the process of converting the kernel into oil, cheap and expeditious. In this country the whole process is yet performed by hand, which is most tedious and expensive, and costs so much, that it is scarcely worth making. As the cultivation of cotton is likely to increase, such a machine might effect a great saving here, although not millions of dollars as in the United States. The oil could be extracted from the seed, and the oil cake would then be nearly as valuable as food for cattle as the seed itself, which is now given to cattle, and both oil and cake, which could be sold cheap, would meet with a ready sale in this country.

Rajharrah: I remain, &c.
23rd May, 1846. C. B. Taylor.

[*From the Library of Entertaining Knowledge.—Vegetable substances, Vol.* 3, *pages* 44, 45, 46, *and* 47.]

The separation of the cotton from the seeds is a very long and troublesome operation when performed by the hand; for the fibres of the cotton adhere tenaciously to the seed, and some time is consumed in cleansing even a small weight of so light a material. In

the greater part of India, the use of machinery for this purpose is unknown, and all the cotton is picked by hand. A man can in this manner separate from the seeds scarcely more than one pound of cotton in a day. In some parts of India, however they make use of a machine, which, though more simple, does not materially differ from the gin used in the West Indies. Dr. Buchanan describes it in 'a journey from Madras through the countries of Mysore, Canara, and Malabar. (Vol. 3, p. 317.) Mr. Clarke Abel also found precisely the same machine in China, at the village of Ta-tung, not far from Nankin. This is his description of it; it consisted of two wooden cylinders, placed horizontally one above the other, on a stand a few feet from the ground. The cylinders, very nearly touching, were put in motion by a wheel acted upon by the foot. The cotton, being brought to one side of the crevice intervening between them during their revolution, was turned over to the opposite; whilst the seeds, being too large to enter, fell at the feet of the workmen.' Mr. Clarke Abel then describes the instrument used by the Chinese for freeing the cotton from knots and dirt. "This is equally simple, and is the same as that used, I believe, in most countries for the same or a similar purpose. It is a very elastic bow with a tight string. In using it the carder places it in a heap of the material, and having pulled down the string with some force, he suddenly allows the bow to recoil; the vibration of the string scatters the cotton about, and separates it into fibres freed from all knots and impurities." (Travels in China, p. 163.) A drawing of an instrument scarcely at all differing from this Chinese cotton-bow is given by Sonerat, in his 'Voyage aux Indes Orientales,' tom. 1. p. 108. Thunberg says, that in Batavia, he saw "the cotton cleansed from the seed by being laid out on extended cloths, and beaten with sticks, till all the seed was perfectly separated from it." The use of the machine called a gin very much facilitates the process. This machine in general consists of two or three fluted rollers, set in motion by the foot in the manner of a turning lathe, and by its means one person may separate and cleanse sixty-five pounds per day, and thus, by the use of a simple piece of machinery, increase his effective power sixty-five times. A still greater increase may be obtained by the employment of more complex engines. In the United States of America, mills

are constructed on a large scale, and are impelled by horses, steam, or other power. Eight or nine hundred pounds of cotton are cleansed in a day by one of these machines, which requires the attendance of very few persons The American mills are exactly on the same principle as the smaller ones, but are more complete in their appointments. A description of one of the larger sort will therefore comprise all the requisite details of a cotton gin. It consists of two wooden rollers of about an inch in diameter; these are placed horizontally parallel and touching each other. Over them is fixed a sort of comb, having iron teeth two inches long and seven-eighths of an inch apart. This comb is of the same length as the rollers, and so placed that its teeth come nearly in contact with them. When the machine is set in motion, the rollers are made to revolve with great rapidity in opposite directions, so that the cotton being laid upon them it is by their motion drawn in between the two, whilst no space is left for the seeds to pass with it. To detach these from the fibres of cotton in which they are enveloped, the same machinery which impels the rollers, gives to the toothed instrument above a quick wagging motion to and fro, by means of which the pods of cotton, as they are cast upon the rollers, are torn open; just as they are beginning to be drawn in, the seeds now replaced from the coating which had encircled them, fly off like sparks to the right and left, while the cotton itself passes between the cylinders. The sharp iron teeth of the comb moving with great velocity, sometimes break the seeds; then the minute pieces are instantly hurried on, and pass between the rollers with the cotton. These stray particles are afterwards separated by hand, a process which is called moting, entirely to cleanse the cotton from any remaining fragment of seed subjected to another process. This consists in whisking it about in a light wheel, through which a current of air is made to pass. As it is tossed out of this winnowing machine, it is gathered up and conveyed to the packing-house, which, by means of screws forced into bags, each when filled, weighing about 300 pounds. These are then sewed up and sent to the place of shipment, when they are again pressed and reduced to half their original sizes. (Hall's Travels in North America).
Some manufacturers fancy that this wholesale machine tears and injures the fibres of cotton, but it is perhaps an idle prejudice, since

the best cotton which we import is from Georgia, where it is most expeditiously cleansed; and that which obtains the least price comes from the East Indies, where the hand is the only machine used. Another description of gin, called the saw-gin, is likewise used for short staple cotton in the United States and in Brazil. This consists of one roller nine inches in diameter, having a series of circular saws fixed upon it parallel to each other, and at a distance of one inch and a half apart, above this roller is a hopper, having the bottom formed of a grating of wire-work, through which the teeth of the saw project to a certain depth. In this hopper the cotton to be cleansed is placed, and, as the cylinder revolves, the projecting teeth of the saw come in contact with the cotton, and drag it through the wire bottom of the hopper, which being inclined at a considerable angle, the seeds, as they are disengaged, roll down, and are conveyed away through a spout in the machine.

The cotton is more quickly cleansed by this method than by the use of the cylinder gin, but at the same time it tears and injures the staple. It is usual in the Liverpool price currents to denote, as saw-ginned, the cotton of Brazil cleansed by this process, which fetches a lower price in the market than the Brazil cotton, not so operated upon.

[*From the Library of Entertaining Knowledge.—Vegetable substances. Vol.* 3, *pages* 213 *and* 214.]

In America, cotton seed is now made to yeild a very good and serviceable oil; a machine having been recently invented there for hulling the cotton. The object of this operation is not to get rid merely of the hull or skin, but of the fibres of cotton which adhere to it, and which would absorb and retain a large portion of the oil under the press. Previously to this invention cotton seed was treated as refuse and served only for manure. Taking into consideration the quantity of cotton produced in the Southern States, and the relative weight of the seed which it surrounds, some estimate may be made of the vast produce of an article now found to be available for useful purposes.

After the seeds are hulled, they are ground and pressed in a machine of the same construction as the Dutch oil-mills. Cotton seed is much softer, and therefore easier to crush than linseed; the grinding

stones can accordingly be made smaller in proportion to the number of pestles used than those of the linseed oil-mills. The oil thus extracted is refined by a simple and cheap process, so as to answer all the purposes of the best sperm oil; competent judges, who have carefully compared the two, being entirely satisfied of their equality.

After the oil has been expressed from the seed, the residue is a nutritive oil-cake; so that a planter who makes four bags of cotton, obtains by these means forty bushels of good food for his cattle, independent of the oil which may be produced.

"Not long since those who had cotton-gins, felt themselves obliged by any neighbor who was willing to take the seed away, and what might have produced millions of dollars has been rejected as of no value."—*(Franklin's Journal, May,* 1830.)

My dear Sir,—It has struck me, since I sent you a description and drawing of the roller gin, to be worked by bullocks or ponies, that the cog-wheel on the upright shaft might with great facility be made to work two such roller machines as I have proposed; two bullocks or ponies being sufficiently powerful I should think to move round the whole machinery with ease. I therefore beg to enclose another drawing, shewing the proposed new arrangement of the roller machines, (see Plate III.)

Should you think it worth while to have a model made, please to instruct those whom you may engage to make it, to have as many teeth on the large cog-wheel as can be got upon it, in order to increase the speed of the rollers as much as possible.

I suppose it will be understood, that the upright shaft or spindle is to move round in the middle of two strong pieces of wood to be fixed in the upper and lower part of the frame, and which cannot be shown in the drawing, thus—

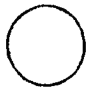
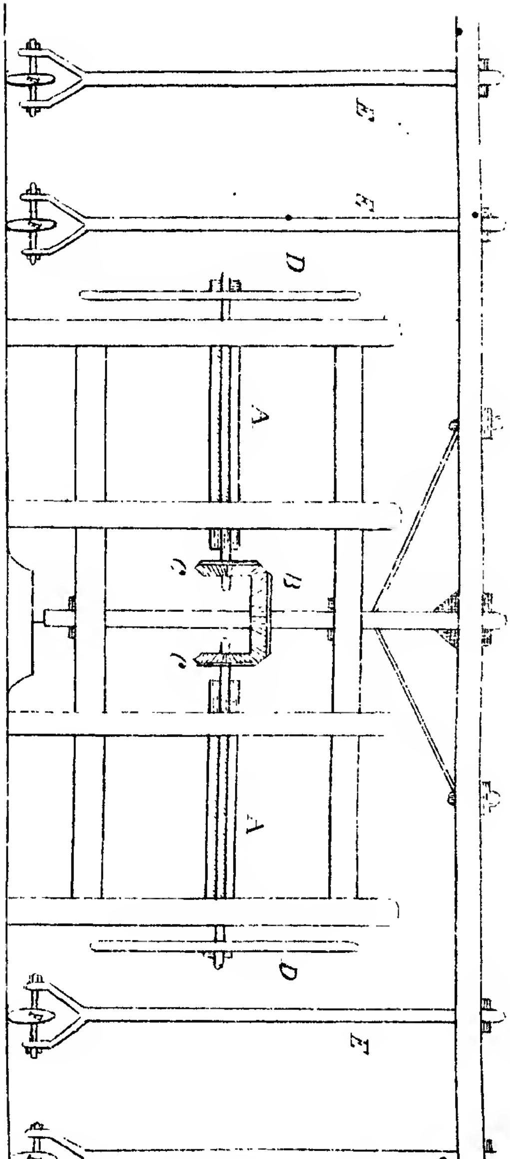
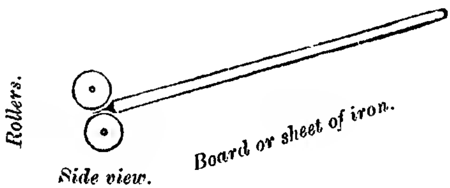


Plate. III.



There are several other contrivances by which I propose to lessen the cost of working the machine, but which are also difficult to shew in a drawing, such as a board or a sheet of iron, to be placed parallel to the whole length of the rollers so as nearly to touch them at the place where they meet, and the board or iron to be placed in such a position as to allow the cotton to slide down upon the rollers, there being openings close to the rollers large enough to allow seeds to escape, but not the cotton to fall through:

To be made of a thin board or a sheet of iron.



Could this improvement be adopted, it would save the labor of two people at the least, but I am not certain that it will be found to answer. I regret my inability to have a model made up here, as I might then have tried all these contrivances myself, and in case of their being found not to answer the purpose intended, could perhaps have suggested something more effectual.

I remain, &c.

June 9th, 1846. C. B. Taylor.

You will observe, that the three pair of rollers as they are placed, will perform the work of four pair.—C. B. T.

My dear Sir,—I must again run the risk of submitting Sketches (IV. to VIII.) of five more machines for clearing cotton of its seed, without being positively certain whether all or any of them will be found very efficient in practice; they are the same in construction as those last forwarded, but are to be worked on a different principle. I consider that I am laboring under a little disadvantage up here in having no one to refer to as to the probable utility of the machines proposed, being obliged to rely solely upon my own judgement and which is liable to be very deceptive in cases affecting one's own contrivances: faults in construction, and objections to the method of working, which I may not be able to perceive may be readily detected by others, but as I know the subject is considered of great importance, and many of the Members being personally interested in the production of an effective machine for the purpose intended, I shall not allow myself to be influenced by any motives of delicacy in withholding what may possibly prove useful, as should they not be found altogether effective, they may suggest to others the idea of contriving something that will answer the purpose more completely; but if I may hazard an opinion as to the comparative value of the different methods proposed of working the machines, I should give the preference first, to the one to be worked by a steam engine, and next to that, I should prefer the one to be worked by a wheel and endless strap.

As to the question whether three or four pair of rollers will be found most effectual, this can only be determined by experience and experiment.

It is not easy to compute with any degree of accuracy the quantity of cotton the machines I have proposed will clear of its seed in a day, but I suppose we may approximate something near the mark. I will therefore take the machine to be worked by a wheel and endless strap, and endeavour to form a rough estimate what it will be likely to effect. It

is said, (see my letter of the 18th May last) that a Negro in the West Indies will clear from 30 to 40 lbs. per day, with one pair of rollers worked by a treadle in the same way that a knife-grinder works his machine. I should therefore conclude, that each pair of rollers fed by a woman or young person would clear double the quantity or 80 lbs., for it must be borne in mind, that the people feeding the rollers are entirely relieved from the labor of working the machine, a man being employed to turn round the wheel; if one pair of rollers will clear 80 lbs., three or four pair will clear 320 lbs., at a cost of 6 annas, as follows :—

	Annas.
2 Men alternately to relieve one another in turning round the wheel and feeding one of the pair of rollers, at 6 pice per day each, ...	3
3 Women or young people, each engaged feeding a pair of rollers, at 4 pice per day each, ..	3
Annas,	6

I suppose you understand that the rollers are to work into one another at one or both ends, on the same principle as those of the chirkee, but I do not think it necessary to have grooves cut diagonally like those on the chirkee, as teeth cut horizontally on the ends of the rollers would, I think, be found to work equally as well, if not better.

I have added a fly wheel in every case, because I believe all machines having a rotary motion ought not to be without one; it is well understood however, that it occasions no increase of power but merely accumulates it, equalizes the motion, and causes the working to go on steadily without jerking.

I remain, &c.

24th June, 1846. C. B. Taylor.

P. S.—I will send you the sketches (Nos. VII. and VIII.) to-morrow.

My dear Sir,—I have now the pleasure to forward the sketches promised yesterday. One (No. VII.) is of a machine with four pair of rollers to be worked by a wheel and endless strap, and the other (No. VIII.) is an assemblage of machines containing thirty-two pair of rollers, to be worked by a steam engine: of what horse power the engine ought to be it is not easy to say without knowing the number of pounds it would take to work one machine, but I should think four horse power would prove sufficient, but it would be better to make certain, and have one of six horse power. In the machines with three and four pair of rollers I have supposed that it would require an engine of the power of two horses to work it, but I suspect it would not take much more than one, and thought it better to have a little more power than might be required than be deficient.

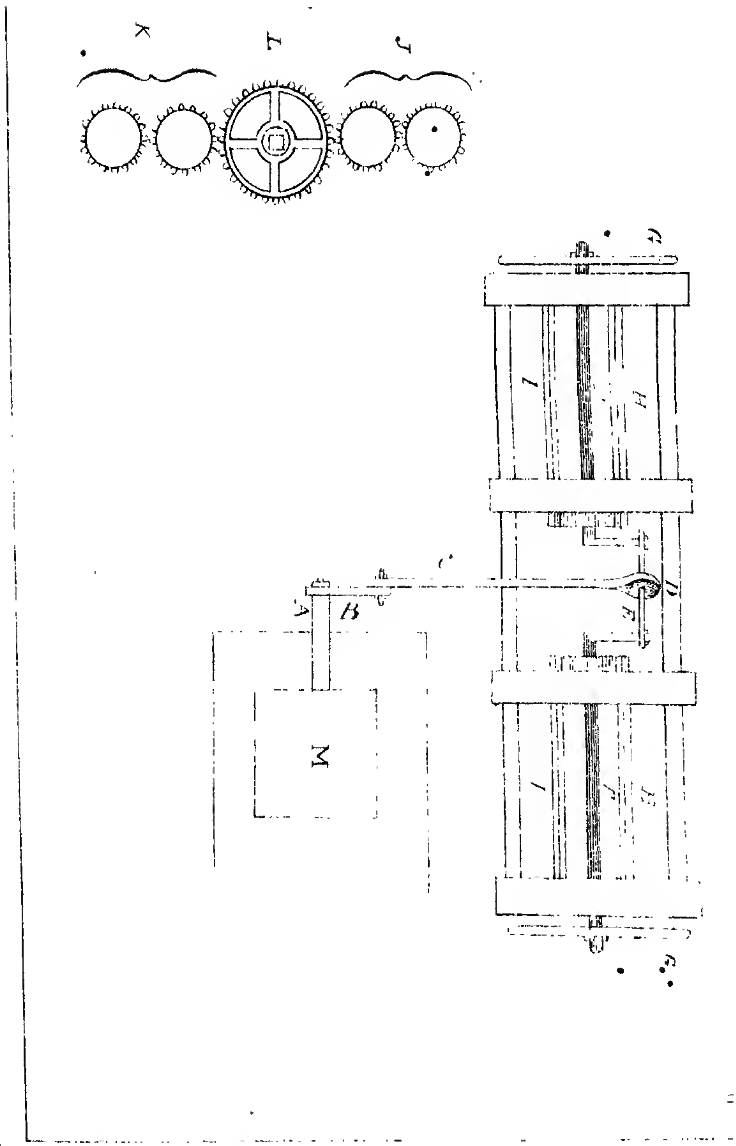
The only alterations required when so many pair of rollers are to be worked by one engine, would be merely to have the iron axle that runs through the whole machine made of sufficient strength, to enable it to overcome the extra resistance it would have to contend with in moving round so many more rollers, and also to have the connecting rod made stronger.

This machine (Plate No. VIII.) is in fact nothing more than thirty-two chirkees, so combined that they can all be put in motion at the same time and by one engine, and if they can be made to work well, ought to clean from twenty-five to thirty-two maunds of cotton per day, at a cost of two rupees a day, supposing the contrivance for feeding the rollers mentioned by me in my letter of the 9th instant cannot be made to answer, nor any other method discovered of making the rollers feed themselves; but in this two rupees I only include the expence of feeding the rollers.

I remain, &c.

Rajharrah Colliery, Palamow: C. B. Taylor.
25th June, 1846.

Plate. A



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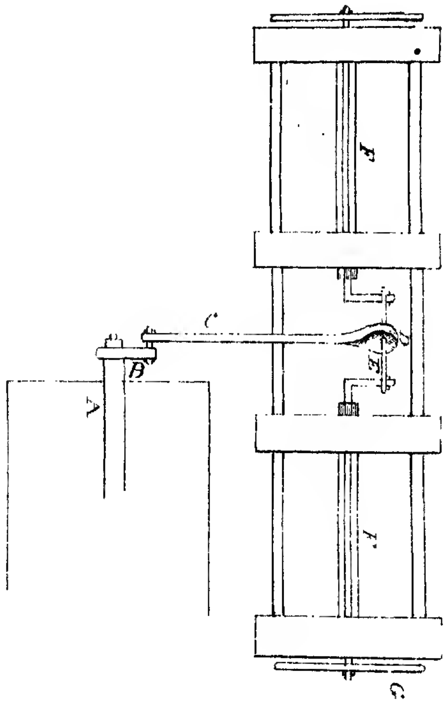

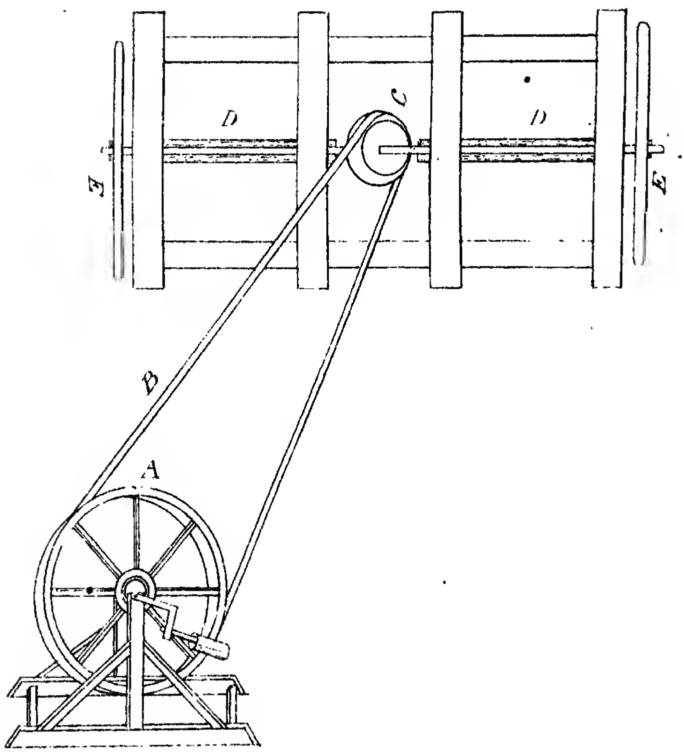
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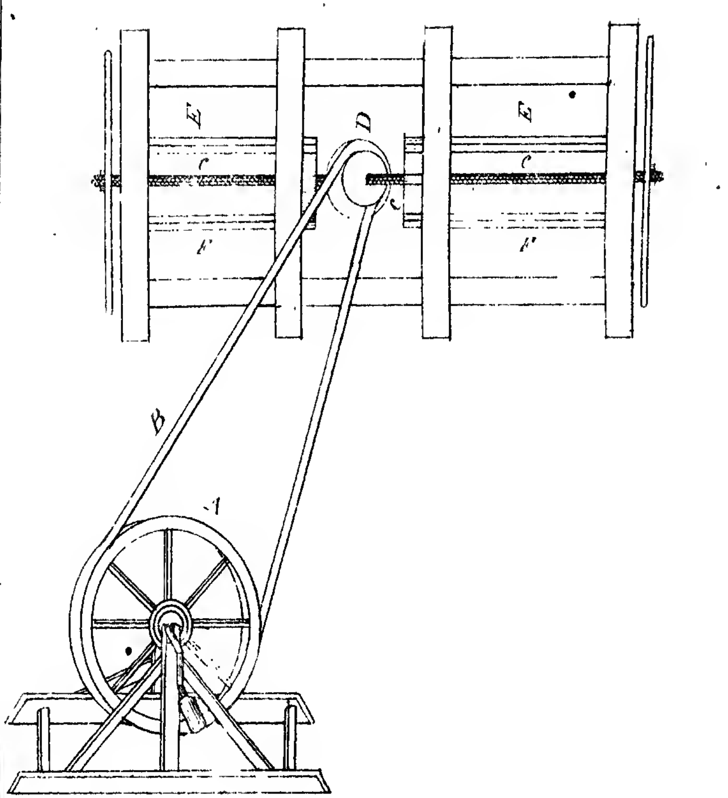
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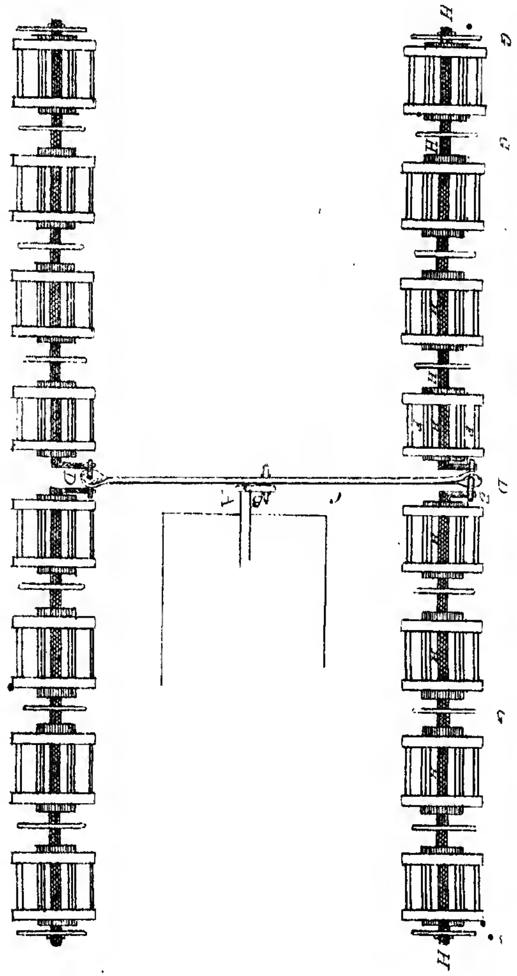


My dear Sir,—When I wrote you on the 24th ultimo, I thought I had wholly exhausted the subject of cotton-cleaning machines, about which I have written so copiously, but it appears not; for on reading the XIII. Chapter of Baines' History of the cotton manufacture, which gives some account of the soil and climate essential to produce fine cotton, also the method of cultivation adopted in the United States, I found a description of the machines, a notice of which I extracted from the Library of Entertaining Knowledge and forwarded in my letter to your address of the 18th May last, and which it was stated cleaned 900 lbs. of cotton per day. I now beg to give you the extract in full, relating to the machine for cleaning cotton, from Baines' excellent work.

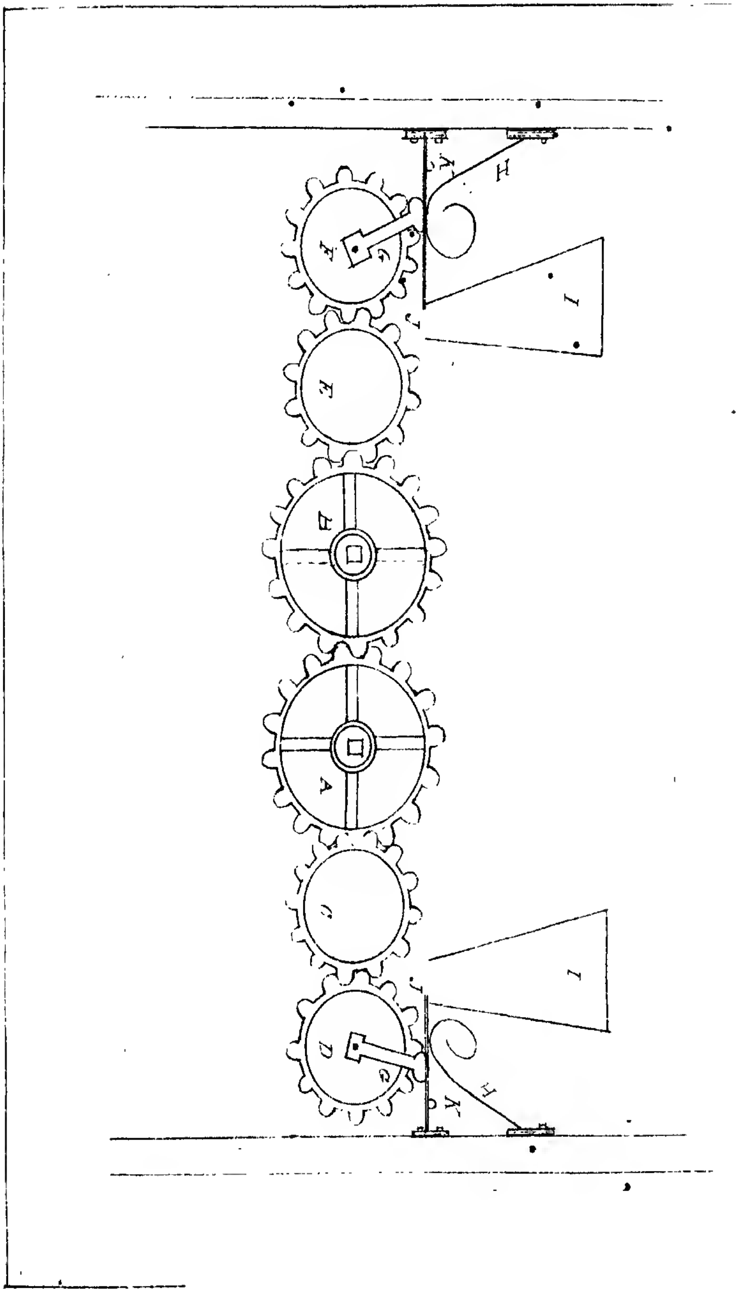
"It consists of two wooden rollers of about an inch in diameter, these are placed horizontally parallel, and touching each other. Over them is fixed a sort of comb, having iron teeth two inches long and seven-eighths of an inch apart. This comb is of the same length as the rollers, and so placed that its teeth come nearly in contact with them. When the machine is set in motion, the rollers are made to revolve with great rapidity, so that the cotton being laid upon them, it is by their motion drawn in between the two whilst no space is left for the seeds to pass with it. To detach these from the fibres of cotton in which they are enveloped, the same machinery which impels the rollers gives to the toothed instrument above a quick wagging motion to and fro, by means of which the pods of cotton, as they are cast upon the rollers, are torn open just as they are beginning to be drawn in; the seeds now released from the coating which had encircled them, fly off like sparks to the right and left while the cotton itself passes between the cylinders. The sharp iron teeth of the comb, moving with great velocity, sometimes break the seeds; then the minute pieces are instantly hurried on and pass between the rollers with the cotton. These stray particles are afterwards separated by hand, a process which is called moting. Entirely to cleanse the cotton from any remaining fragment of seed, it is subjected to another process. This consists in whisking it about in a light wheel, through which a current of air is made to pass. As it is tossed out of this winnowing machine, it is gathered up and con-

veyed to the packing house, where by means of screws it is forced into bags, each when filled, weighing about three hundred pounds. These are then sewed up, and sent to the place of shipment, where they are again pressed, and reduced to half their original size."—*Baines' History of the Cotton Manufacture, Chapter XIII, pages* 299 *and* 300.

You will observe, that the rollers are placed horizontally, and are made of wood. I therefore beg to send you another sketch (No. IX.) of my machine, in which I have also placed the rollers horizontally instead of vertically, which I think most likely to prove the best arrangement. Any number of rollers, from four to thirty-two pair, may be worked by this new arrangement of the rollers, and by any moving power that may be found most convenient, such as the wheel, endless strap, and pulley, steam engine, or horses, and it would appear to have the further advantage of admitting the rollers to be fed by means of a hopper, or sort of a box in which is a small opening at the lower part, to allow the cotton to fall through upon the whole length of the rollers at the line where they meet. Mr. Baines does not say a hopper is used, but I think it probable that one might be used to feed the rollers, and cause some saving in the attendance, the same as that described in Nicholson's Operative Mechanic; on the other hand, a hopper might interfere with the motion of the comb. In the sketch which I now enclose, I have placed the comb horizontally over the rollers, but it is possible that in the American machine the comb may be placed vertically, in which latter case a hopper could not be used for feeding the rollers.

In the enclosed sketch I have not thought it necessary to give you any thing more than an end view of the wheels and rollers, as the whole working of the machine will be well understood by reference to my former sketches. I have been obliged, however, to place an additional wheel between the two pair of rollers, as one wheel would cause the rollers to turn different ways, and both pairs must be made to turn in upwards towards each other.

Plate IX.



The means by which the comb is made to vibrate, and the manner in which it is fixed to the machine, is not mentioned by Mr. Baines. I have therefore supposed it to be fixed horizontally over the rollers, and within half an inch of them, and working upon a hinge the whole length of the rollers; the hinge must be within an inch of the frame, the vibrating motion may be communicated to the comb by having an iron arm attached to both ends of one roller in each pair, as shewn in the sketch, these arms in moving round with the roller would strike underneath the comb, and would raise it an inch or one-half each revolution, it would then be forced down by a steel spring fixed over it; the teeth of the comb ought to project so as to be nearly over the line where the two rollers meet, and just below the hopper if it be found practicable to use the latter.

I have assumed, that plain steel rollers will answer the purpose as well as wooden ones, but it is possible that they will require to be fluted, or perhaps covered with buff leather in the circumference.

Rajharrah Colliery, Palamow: I remain, &c.
20th July, 1844. C. B. TAYLOR.

EXPLANATION OF THE PLATES.

Plate I.—A GIN with three steel rollers, to be worked by two bullocks.

N.B.—This is not made to a scale.

A. A. A. Frame.
B. Large cog-wheel on an iron spindle.
C. Small ditto ditto.
D. Fly-wheel.
F. Lever.
G. G. G. G. Iron supports, running a wheel to keep the lever steady; from the iron spindle to the out support is about six and a half feet, or about thirteen feet altogether.
Rollers about eighteen inches in length between the frame.

Plate II.—A CIRCULAR GIN.
A. Nave of fan.
B. B. B. B. Wooden vanes or beaters.
C. C. C. C. Iron bar.
D. D. D. Frame.
E. Box to receive the seeds as they fall through the holes.
F. F. F. F. The place where holes are to be made.
This machine may be worked by hand, or any other power can easily be applied to it.

Plate III.—A ROLLER GIN.
A. A. Rollers.
B. Large cog-wheel.
C. C. Small ditto.
D. D. Fly-wheels.
E. E. E. E. Rods of iron to support the lever.
F. F. F. F. Thick rollers for the supports to run round on.

Plate IV.—A MACHINE, consisting of four pair of steel rollers, to be worked by a two horse-power steam engine.
A. Main shaft of steam engine.
B. Crank.
C. Iron rod connecting the steam angine with the roller machine.
D. Brass knob fixed at the end of the connecting rod, for tha winch to pass through and to move round in.
E. Winch, the upper part of which to go through the brass knob, and can be taken off when necessary.
F. F. Iron axles.
G. G. Fly-wheels.
H. H. Upper pair of rollers.
I. I. Lower pair of rollers.
M. Steam engine.
End section of rollers and the wheel that turns them.
J. Upper pair of rollers
K. Lower pair of rollers.
L. Wheel to turn rollers.

Plate V.—A MACHINE, consisting of three pair of rollers, to be worked by a small steam engine.
A. Steam eogine main shaft.
B. Crank.
C. Iron rod connecting the steam engine with the machine.
D. Brass knob at the end of the connecting rod, for the handle which turns the rollers to pass through, and to move round in.
E. Upper part of winch, which comes off to allow the rod to be attached to it.
F. F. Rollers.
G. G. Fly-wheels.

Plate VI.—A MACHINE, consisting of three steel rollers, to be worked by a wheel and endlass strap.
A. Wheel.
B. Endless strap.
C. A wheel fixed to the axle or steel roller.
This wheel ought to be covered with a piece of buff leather in the circumference to prevent the strap from slipping.
D. D. Three pair of steel rollers.
E. E. Fly-wheels.

Plate VII.—A MACHINE to be worked by a wheel and endless strap.
A. Large wheel.
B. Strap to turn the pulley D.
C. C. C. Axle.
D. Pulley to be covered in the circumference with buff leather.
E. E. Upper pair of rollers.
F. F. Lowar pair of rollers.

Plate VIII.—A MACHINE, consisting of thirty-two pair of (bright) steel rollers, to be worked by a steam engine of from four to six horse-power.
A. Steam engine main shaft.
B. Crank.
C. Iron rod connecting steam engine with both set of machines; in the sketch it is of one piece, but it may ba made in two, for the conveniencа of beiog able to work one set of machines at a time
D. D. Brass knobs at the ends of the iron rod, for the upper part of the winch to pass through and to move round in.
E. E. Upper part of the winch; which comes off to allow the rod to be fixed to it, and is secured by screws and nuts.
F. F. Upper and lower pair of rollers.
G. G. G. G. Fly wheels.
H. H. Iron Axle, which runs through the whole length of each set of machinea.
Tha wholo of the machinery, not includiog the steam engine, would doubtless prove rather expensive, as I find it would take 160 small brass bushes for the axle and rollers alone.
The whole langth of one set of machines, allowing the rollars to be from twelve to eighteen inches long, would be about eighteen or twenty-two feet.

Plate IX.—END VIEW of a machine for cleaning cotton.
A. Wheel through which tho axle is to pass.
B. Wheel which is to turn the rollers E. F. upwards.
C. End of roller.
G. The iron arm attached to the two outer rollers F. D., and which is to strike underneath the comb J. and to raise it about half an inch.
H. Steel spring to force down the comb when raised by G.
I. Hopper for receiving the cotton.
J. Comb fixed to the frame.
K. Hinge to allow the comb to be raised.

On the mode of cultivating and preparing Tobacco, as practised in the district of Rungpore. Communicated by H. Rehling, Esq.

To James Hume, Esq., *Secretary, Agri-Horticultural Society: Calcutta.*

My dear Sir,—According to promise, I have much pleasure in forwarding a small supply of Rungpore tobacco seed, with the accompanying memorandum with regard to the cultivation of this staple as practised in this district, and hope it may prove acceptable to the Society. I have also procured some tobacco leaves which I shall forward by dâk bangy.

Soil and manure.—This important staple is extensively cultivated on the high sandy tracts with which this district abounds, particularly in the neighbourhood of the station, and the country in a direct line, north, west, and east from the same. The cultivation is very limited towards the south, where very little is raised beyond the quantity consumed on the spot. This plant courts a rich sandy soil, possessing the properties of keeping cool and moist till the plant comes to perfection, and becoming dry when the plant has come to perfection and the leaves ripen. The lands must be well manured; and the manures generally in use are cow-dung and indigo weed, but preference is given to the latter, which has become the means of bringing extensive tracts of sandy and barren lands under cultivation, and the mode of applying the same is as follows:—As soon as the steeped plant is thrown out of the vats, it is carried out to the fields, which must previously be broken up with the plough, the weed is thrown up into small heaps at convenient distances, according to the richness or poorness of the lands to be manured, and a layer of earth is thrown over the heaps; the weed is then allowed time to undergo decomposition, and as soon as this has taken

place it is ploughed into the soil, and the lands prepared for planting.

Mode of raising Plants.—The seed is generally sown late in August and early in September. The seed beds must be raised and well prepared with fine mould, free from clogs and weeds, and care must be taken not to sow the seed too deep. Small shades thatched with straw must be kept in readiness, to cover the beds with in case of heavy rain, and protect the young plant from the injurious consequences of the same. Some have the practice of covering up the seed beds with a thin layer of loose straw till the plants appear above ground, which takes place about fifteen and twenty days after sowing. As the plant grows up the beds must be kept clean and free from weeds, and protected from heavy rain.

Planting, and treatment after Planting.—Early in October the plant will be ready for transplanting, and will, by that time, have put forth five and six leaves. The operation of planting is continued till the middle of December, but what is planted later will never yield a good crop, as the soil becomes too dry and will therefore not allow the young plant to fix root and thrive. On low damp lands I have seen planting continued till January, but such lands can never yield tobacco of even middling quality. After having manured the lands well, as above stated, with indigo weed or cow-dung, the soil is well ploughed up and worked very fine, and receives the same care and treatment as good vegetable-garden soil. The plants are placed in rows three feet apart, allowing the same space between the plants in the rows. In case the soil is very dry, watering is necessary till the plants have fixed root. It will also be advisable to protect the plants from the rays of the sun, for which purpose the bark of green plantain trees, cut into pieces a foot in length, is admirably adapted for keeping the tender plant cool during the heat of the day. (I may here mention, that I have adopted this plan in trans-

planting cabbage plants.) As the plants grow up, the soil is well stirred about and kept perfectly clean from weeds, this process is very much facilitated by dragging a small rake between the rows from both sides, i. e. from north to south and east to west, thus only leaving a small space round the roots untouched by the rake. This operation is frequently repeated, and the *pason* (hand hoe) is used to remove whatever weeds the rake has left untouched. In case the soil is not well manured, it is dressed with oil-cake and cow-dung, mixed together and made into a powder, this manure is applied round the roots and well mixed up with the soil. As soon as the plant has put forth five and six large leaves, the growth is checked by nipping off the flower buds, but the plant will now send forth new sprouts and leaves, which must be carefully removed as soon as they appear. The advantage of this process is not only that a longer leaf is obtained, but of a better quality, as all the sap of the plant is delivered to the leaves. Soon after this operation has been performed, the small leaves below the large leaves which have been reserved, are also removed and left on the ground for a few days to dry, when they are tied up into small bundles and slung up under a roof. These leaves are consumed by the poorer class in their hookas.

Gathering and preparing the leaves.—As soon as the leaves have attained sufficient ripeness, i. e. as soon as the leaves change from a green to a yellowish hue and become brittle, and have altogether a rough and shrivelled appearance, the operation of gathering the leaves commences, and this consists in cutting off the leaves from the trunk, allowing a small portion of the bark of the same to adhere to the leaves. As the leaves are removed, they are spread on the ground and allowed to wither so as to become flexible, but not too dry, when they are carried under shade. Here the leaves are tied into bundles, each consisting of two or four leaves accord-

ing to their use, and strung in rows on *kabaries*, (long thin slips of bamboos) which are again slung up under a flat shade thinly thatched with straw; then they are left till the leaves assume a light brown color, when they are removed under a house, and slung up to the roof of the same, one row following the other down the slope of the roof. The leaves are here allowed to become perfectly dry, when they are taken down and put up into bundles of different sizes; but care must be taken to chose a damp and rainy day to perform this operation, for if the day is too dry and hot, the leaves become so brittle that they break and get injured. The operation of sweating and fermenting the leaves is not in use here, and I have no doubt, that if the improved mode of curing the leaves as practised in Cuba is substituted, instead of the rough operation in use here at present, a far superior article might be produced. I regret to say I have had no opportunity of making experiments, but as I intend to cultivate the plant myself this season on a small scale, I shall introduce the improved mode of curing the leaves, and I shall not fail, in due course, to forward samples, and report the result of my experiment to the Society. I had nearly omitted to mention that, when the leaves are made into bundles, a thin layer of fresh straw is applied round the bundles.

Extent of cultivation and produce, &c.—The extent cannot be given with any degree of certainty, but I would estimate the yearly produce at nine lacks of maunds. I have no certain data on which to found the above estimate, but my guess is based on the probable extent of cultivation and produce per biggah. The extent of tobacco cultivation in this district, I would estimate, at least, three lacks of biggahs; and one biggah will, on an average, yield three maunds of tobacco. In estimating the extent of cultivation at three lacks of biggahs, I have compared the cultivation of tobacco with that of indigo, and I find they have a proportion of one

biggah of the latter to three biggahs of the former; and the extent of indigo cultivation in this district is estimated at upwards of one lack of biggahs. The tobacco trade of this district is entirely in the hands of the mahajuns from Serazgunge, Pubnah, Culnah, and all the large *bundors* and bazaars of the Lower Provinces; they come up during the rains in large boats, and take down whole cargoes to the above named places. The Mugs come up also with their boats and buy up largely. The price varies according to season and other circumstances from two rupees to three rupees per bazaar maund. Since the indigo factories have been introduced into this district, the cultivation of tobacco has been greatly extended, owing to the fertilizing properties of indigo weed and the vast quantity of manure it yields. The ryotts devote all their time and labor on the culture of this staple, which enables them to satisfy the greatest part of the exorbitant demands made on them by their landlords and mahajuns. I have not been able to ascertain when this plant was introduced, and as I know very little of the plant and its history, I can speak very little about it; but the similiarity the Bengalee *Tamacoo* bears to the Portuguese *Tabacca*, seems to give the credit of having introduced this plant to that nation. The heavy hail-storms this district is subject to about the time when the leaves ripen, and are consequently very brittle, proves very injurious to the tobacco crops, and ruins many a poor ryott.

Chandamaree, Rungpore: I remain, &c.
25th July, 1846. H. Rehling.

On the testing and valuation of the Indigo of Commerce according to Henrich Schlumberger.

Translated from the Magazine for the Promotion of Science: a Dutch periodical entitled Tijdschrift tot bevorldering van nijverheid. By R. W. G. Frith, Esq.

The different kinds of indigo of commerce vary so much in their coloring powers, that it is necessary to ascertain their intrinsic value with reference to the extent of their coloring properties.

It is the more necessary, when we know what uncertain, and indeed, deceptive methods are resorted to, by brokers and agents who are employed in assorting indigo, to enable them to distinguish one quality from another. They generally judge by its outward appearance, color, feel, or according to the degree of compactness of the article. Differences of as much as 54 per cent., in consequence, sometimes exist in different qualities of indigo, with reference to the true value and intrinsic worth of the coloring property. Some indigos are poorer by 65 per cent. in coloring matter than others, and differences even of as much as 15 to 20 per cent. exist often between indigos which have been assorted by brokers as of one and the same quality. This great difference in the quantity of blue coloring matter is to be met with in indigo produced in all countries. For these reasons, it is of the utmost importance to manufacturers to be able to decide exactly the true value, and not only to know thereby the most advantageous price at which to purchase so costly and precious a product, but also to ensure a correct and favorable result in dyeing.

Schlumberger has, for the last ten years, adopted a very simple method, and that with great advantage to himself, whereby he has been enabled to determine the exact value of different qualities of indigo.

His plan is as follows.—The indigo is dissolved in fuming sulphuric acid, and this solution, which is greatly diluted with water, is afterwards bleached with chloride of lime. Notwithstanding the various foreign substances met with in the indigo, the chloride of lime acts solely on the coloring matter, for many modes of analysis have shown, which will hereafter be proved, that the quantity of chloride of lime required to bleach a given quantity of indigo, exactly coincides with the extent of its coloring powers.

Before proceeding further, he has ready prepared a certain quantity of pure indigo, which serves as a criterion to guide him in his experiments; taking the pure indigo as equal to 100 parts, he puts down in figures the value of the different qualities of indigo experimented on, and these show the percentage of pure blue coloring matter contained therein.

Seeing that pure indigo is easy to make, he makes a point of using it on every occasion in comparison with the usual indigo of commerce, whereby the necessity of determining the intensity of chloride of lime solution is obviated, and not only that, but the test is the more sure; the causes which should point out the result are therefore always to be looked for under similar circumstances, as well in regard to the normal indigo as those under investigation.

To obtain pure indigo, he collects the scum, which is formed and remains unbroken on the surface of the blue vat, and in which the indigo, by addition of lime and sulphate of iron, has been deoxydized. Into these vats are generally put one part of water in which indigo exists in solution, three parts lime, and three parts sulphate of iron, in 5,000 or 6,000 parts of water. This scum is digested with a quantity (or *sufficiency)* of a solution of muriatic acid (or spirits of salts) and water, and the remainder afterwards well washed until all the soluble matter is removed; after this, the indigo which is obtained, is dried and taken care of in a glass stoppered bottle,

to prevent any effect from damp. Should the indigo vats not be available, a mixture is then made of three parts of slaked lime, three parts of sulphate of iron, one part of indigo finely triturated with water, and fifty parts of water. This is stirred together for several hours, then allowed to settle, to enable the fluid part of it to be the easier poured off, when the remainder is then again well stirred round to allow the air to be brought in contact with all parts of it, that all the indigo by oxydization may be precipitated. The sediment, thus obtained, is lastly treated with muriatic acid, the same as the scum from the vats.

When indigo is to be tested, a gramme of it very finely pulverized, is to be weighed off in a very exact scale, and this is put in a porcelain plate of about eight *Dutch inches* in diameter.

After all the samples of indigo have been weighed out, 12 grammes of fuming sulphuric acid measured off in a graduated tube are poured into each plate; with the aid of a pestle, the indigo must be well triturated and mixed up with the acid, so that all the solid particles may be reduced, and come in contact with the liquid. The vessel must then be placed for four hours in an oven heated to about 50° or 60° of Celsius (equal to 122° to 140° of Fahrenheit's scale;) or perhaps what is still better, place it covered up in a room heated to 20° or 25° Celsius. In the mean time are put out as many glass cylinders as there are solutions of sulphuric acid, and each capable of containing a Dutch can of distilled water, when to each solution is added a like quantity of water out of a Dutch can. The liquid becomes heated; it is again stirred round with the porcelain pestle, after which water enough is added until the bowl is filled, the whole is then emptied out into the glass cylinder, the bowl is washed out with water from the Dutch can, and the contents of the can emptied into the glass cylinder. A solution of chlo-

ride of lime is now got ready of about 1° Beaumé, and a tube provided, divided into two or four divisions. The solution of sulphate of indigo, which was previously well mixed up, is now measured off in a tube, divided into 100 equal parts, like the Alkalimeter of Descroiville, a small portion of this is then poured into a basin, in which this being stirred at the time, is at once mixed with the quantity of chloride of lime already in the tube.

Should the color of the liquid be changed at once into a yellow, it is a proof that there is an excess of chloride of lime; in this case the solution of indigo must continue to be added to it, until a greenish color shews itself. Having proceeded thus far, it must be ascertained how many parts (degrees) of sulphate of indigo have been obtained, when the test is again repeated, until it is at once ascertained by a single admixing of chloride of lime and the solution of indigo, that the exact degree or rather the complete bleaching of the indigo solution has taken place, when there will no longer appear any signs of an excess either of chloride of lime or of the indigo solution, that is, if the fluid is of a light olive-green color. If on first mixing the liquid is of a bluish color, it is a sign that there is an excess of indigo, in that case the test is again repeated in such a manner that a smaller quantity of the indigo solution may be poured into the plate with the view of procuring the olive-green color at one single admixing. The same process is gone through with the solution of indigo, as well as that of the other samples; the following proportions are then put down to ascertain the exact true value of the indigo under trial. The value of the coloring property in indigo is *in the inverse ratio* proportionate to the quantity of the indigo solution used for bleaching; so that when P stands for number of degrees of solution of the indigo of commerce, you have $\frac{100 \times P =}{c}$ $x =$ to the number of actual degrees of the indigo under trial, which points out the quan-

tity of coloring matter existing in 100 parts of the same. Whenever it so happens, for instance, that pure indigo requires 54 parts of its sulphuric acid solution ere it can be bleached by the chloride of lime, although one of the qualities under test requires fifty-four parts of its solution, then you have $\frac{100 \times 54}{64} = 84.5$; that is 100 parts of this indigo of commerce contain 84.5 of pure indigo.

Suppose an indigo which contains 73 per cent. of pure indigo in 100 parts, and costs 28 fr. the Netherlands pound, you have $\frac{28}{73} =$ fr. 0.38 cents for one grain of pure indigo; while another containing 85 per cent., costs 23 fr. the Netherlands pound, you have $\frac{23}{85}$ fr. 0.27 for one grain, which shows a difference on the price of thirty per cent. in favor of the last mentioned quality.

In order to make certain of the correctness of these results, all the samples of indigo which are to be tested must be in the same hygrometrical state, as also the quantity of which the quality is to be determined. All the samples ought consequently to be deposited in glass stoppered bottles as soon as they are taken out of the chests, with a view to prevent either more moisture being taken up, or becoming more dry before they have been weighed off.

If a chest contains several different qualities of indigo, a cake of each should be selected, from each of which a small piece may be broken off, and these mixed together and triturated, so that the result upon testing them may be as near an average as can possibly be obtained. When however, the difference in the one and same chest of indigo happens to be considerable, it is more advisable that the different qualities should be tested separately.

Thus far, Schlumberger barely used twelve parts of fuming sulphuric acid for dissolving one part of indigo; probably it would be better to use a little more of the acid, say fifteen parts, to prevent, under all and every circum-

stance, the formation of *Phœnicine*, and to endeavour to convert the whole of the coloring matter into the sulphate of indigo.

The thorough admixing of the indigo with the sulphuric acid is of the greatest importance as regards the operation. The sulphate of indigo, as well as the solution of chloride of lime, are greatly diluted with water. The experiment is not then so liable for many reasons to error as it is with strong solutions. Besides, when the blue liquid is very weak, it is easier to ascertain the degree of coloring at which the operation must cease.

Water containing chalk or other impurities must on no account be used in these trials for the purpose of diluting the blue solution; either distilled or rain water should be employed.

The exact degree of bleaching, or the moment at which the working must cease, is the easier to determine according as the indigo is pure and thoroughly dissolved. Even with pure indigo, the liquid which has been mixed with the chloride of lime solution becomes yellow, although it is scarcely necessary to add a drop of the indigo solution to it to obtain a blue tinge, showing thereby an excess of indigo. By this means the accuracy of the mode of test is brought down to about half per cent.

With some inferior kinds of indigo, however, it is more difficult to hit the exact moment at which the bleaching process must cease, as in this case the bleached liquid in many instances assumes an olive-green tint; there must then be added two or three grains of indigo, to effect the change from the yellow to the blue color.

Schlumberger preferred the mode of estimation by the change produced in a given quantity of chloride of lime on dropping into it the solution of indigo, to the reverse practice of dropping the decolorating fluid into the latter; because

the indigo solution, admitting of greater dilution with water, the divisions on the graduated tube are rendered more sensible.

Chevreul in his *Leçons de Chimie appliquée à la teinture,* has proposed several different methods for examining indigo. One of these consisted in dissolving the indigo in sulphuric acid, on the bleaching of the blue solution with the aid of chloride of lime; but Chevreul came to the determination that this, though a quick and handy method, produces no favorable results; and that, when the value of indigo is to be determined to a nicety, one proof with another should be compared.

Schlumberger proposed therefore, before adopting the method just described of appreciating indigo, to satisfy himself of its correctness in different ways, and obtained against his expectations the most favorable results.

With that view he prepared blue vats with pure indigo of 100 degrees, of Java of 84·3, according to the chloride of lime proof, and lastly of Carakas indigo of 56 degrees. One gramme of each kind of indigo he deoxydized and dissolved with three grammes of sulphate of iron, and three grammes of burnt lime, in 1,000 grammes of water. By coloring small pieces of cotton in these vats, of great differences in intensity, the color seemed to correspond with the degrees obtained by the chloride of lime test; he obtained likewise by dyeing, colors which in intensity agreed minutely when he reduced the blue vats to one standard with more or less water, in proportion to the purity and coloring power, as indicated by the chloride of lime test.

Thus the vat of pure indigo contained 1,756 grammes of water, that with the Java indigo 1,506 grammes, and that with the Carakas was left with 1,000 grammes water, whereby the same is obtained for the quantity of water as that for the pureness of the degrees of the indigo, namely 100: 84·3: 56.

Each of these vats contained likewise 1,756 grammes water for each grain of pure indigo.*

By deoxydizing and dissolving five grammes of Java indigo of 84·3 degrees of purity, and on the other hand, five grammes Carakas indigo of 56 degrees, in a sharp corrosive potash lye, sulphate of iron and water, then again oxydizing and precipitating the clearer particles by exposure to the air, washing the precipitate with diluted muriatic acid, and finally washing with water and drying,—he thus obtained out of the Java indigo 3·50 grammes, and out of the Carakas 2·23 of pure indigo. Though the residue holding iron was well washed with caustic potash ley, it still contained a tolerable portion of indigo. Treated with muriatic acid, these residues gave up the greatest part of their oxyde of iron, and then there remained a sediment holding indigo, which he again deoxydized afresh with potash and sulphate of iron. The indigo precipitated by this fresh solution, and that produced by the first method, amounted to 0·44 grammes of the Java and 0·36 grammes Carakas.

The sediment holding iron produced by this second deoxydization, still contained some indigo, that however was

* To be enabled thoroughly to deoxydize the whole of the indigo in these vats, he stirred up first, the mixture of indigo, sulphate of iron, and lime, with about 30 grammes of lukewarm water together, then he left it to draw for 24 hours, and often stirred it round ; after this, this deoxydized indigo was added to the remaining water ; it was then allowed to stand for 24 hours, that the pieces of cotton might then be for a minute steeped therein. The vat is first well stirred up, that the sediment which is formed from steeping so long, may be held in solution in the fluid. After the stuff had been taken out of the vat, it was exposed to the air to oxydize the indigo, washed and passed through water prepared with sulphuric acid, washed again and then dried. The dyed musters of cotton showed at the last trial not only almost no change in the intensity of the color, but there was also no difference in the brightness of the blue color visible, whichever of the three very different kinds of indigo it was brought through.

neglected to be treated further. In both processes taken together, he acquired out of the Java indigo 3·94 grammes pure indigo, equal to 78·6 parts of pure indigo, or 100 parts indigo. If the blue coloring matter which remained mixed with the *last* sediment holding iron is brought to account, then you will come very near to the 84·3 degrees of pureness, as shown by the chloride of lime test.

Schlumberger obtained a similar result with the five grammes of the Carakas indigo of 56°, which produced in both oxydizations 2·59 grammes pure indigo, and which is equal to 51·8 parts of pure indigo, or 100 parts of indigo. This amount approaches also pretty near to that produced by the chloride of lime, particularly when the indigo remaining in the sediment holding iron of the second working is taken into calculation.

Finally, Schlumberger made another trial, which according to his belief, gave the most clear and positive evidence of the correctness of his mode of test. He took, namely, 5 grammes of Java indigo of 84·3 according to the chloride of lime test. Having thoroughly triturated it, he digested it with boiling water, that all the soluble substances might be drawn out of the solution. The remaining insoluble matter is after that treated repeatedly with boiling alcohol, which in the commencement became of a dark purple-red color; by the last digestion with alcohol, no further solution took place, and it remained uncolored. The portion which was insoluble in alcohol, being treated with diluted muriatic acid and again subjected to a second working with alcohol, then dryed, produced 4·31 grammes pure indigo, which is equal to 86·2 parts of pure indigo, or 100 parts indigo. This amount again comes very near to the 84·3 degrees, which he got in the beginning by the chloride of lime test.

These different tests leave not a shadow of doubt as to the correctness with which the chloride of lime proof indicates

the purity of different indigos, or the quantity of pure coloring matter existing in 100 parts of indigo.

In order to show the importance of examining the indigo of commerce, he has communicated to us in the following tables, the results ascertained by himself with different kinds of indigo the last time.

Description of Indigo.		Price of one pound at Mulhausen.	Degrees of purity or quantity of pure Indigo existing in 100 parts of Indigo.	Price of one grain of pure Indigo.
Java Indigo		Francs.		Cent.
Very fine violet,		19	71	26.8
Fine violet,		24	88	27.3
Fine violet,		22	78	28.2
Superfine violet,		25	85	29.4
Superfine violet,		26	84	31.0
Purple,		28	89	31.5
Superfine violet,		25.50	81	31.5
Very fine violet,		23	71	32.4
Purple,		29	89	32.8
Superfine purple,		32	96	33.3
Superfine violet,		26	74	35.1
Superfine purple,		30	84	35.7
Fine blue,	Out of one and the same unassorted chest,	...	88	25.7
Violet and blue,		...	85	26.4
Violet and blue,		...	81	26.8
Dark violet blue,		...	77	29.2
Pale ? violet blue,		22.50	72	31.2
(Black) dark blue,		...	64	35.1
Fine blue,	Out of one and the same chest,	...	73	26.7
Fine purple violet,		19.50	63	31.0
Dark blue,		...	56	35.0
Bengal Indigo.				
Fine violet,		23	85	27.0
Fine violet,		22	78	28.2
Fine violet,		23.25	82	28.3
Fine violet,		23	79	29.1
Superfine violet,		23.90	82	28.3
Fine violet,		22	74	29.7
Fine violet,		21.50	70	30.7
Superfine violet,		25	80	31.2
Superfine violet,		26	83	31.3
Fine violet,		25	78	32.0

Description of Indigo.	Price of one pound at Mulhausen.	Degrees of purity or quantity of pure Indigo existing in 100 parts of Indigo.
Bengal Indigo.	Francs.	
Superfine purple, ...	31.75	95
Fine red violet,...	26.50	75
Light speckled (limy ?) (very hard),... ...	16	45
Violet, ...	21	66
Fine purple violet, ...	28	73
Carakas Indigo, ...	20.50	81
Ditto ditto, ...	18	70
Ditto ditto, ...	16	59
Ditto ditto, ...	20.50	75
Ditto ditto, ...	19.50	66
Ditto ditto, ...	17.50	56
Guatemala Indigo.		
Flora, ...	18	55
Kurpah Indigo.		
Kurpah indigo, ...	15.50	74
Kurpah indigo, ...	18	78
Kurpah blue, } Out of one and the same chest,	..	68
Violet and blue, } Out of one and the same chest, ...	13.50	54
Violet blue, } Out of the same chest,...	...	64
Dark blue, } Out of the same chest,...	14.50	64
Violet blue, } Out of the same chest,...	...	63
Dark violet blue, } Out of the same chest,...	16.50	60
Madras Indigo.		
Madras indigo, ...	12.80	58
Ditto ditto, ...	12.10	42
Ditto ditto, ...	14	32
Manilla Indigo.		
Blue, } Out of the same chest, ...	..	50
Dark blue, } Out of the same chest, ...	16	42
Ordinary blue, } Out of one and the same chest,	...	42
Very dark blue, } Out of one and the same chest, ...	14.50	40
Bombay Indigo.		
Light blue, } Out of one and the same chest,	...	35
Pale blue, } Out of one and the same chest,	9	31
Much speckled, } Out of one and the same chest, ...	...	29
Blackish brown, ·	9	27
Philippine Indigo.		
Philippine indigo, ...	18	43
Indigo from the Polygonum tinctorium,* .	...	43
Ditto ditto, ...	...	34
Ditto ditto, ...	...	28
Ditto ditto, ...	...	14

* This Indigo prepared from the Polygonum tinctorium was sent to the Societé Universelle by Spoerlin of Vienna.

On comparing, in the above table, the price of the indigo with the degree of its purity, a very great discrepance is apparent. In one kind the degree of pure indigo is stated at 44 centimes in one Dutch pound, while with another of same kind it is barely 10 centimes, which makes a difference of nearly 55 per cent. in favor of the last named sort, which to look at is apparently equally rich in coloring matter. From this we learn, that frequently indigos of different tints show little or no difference in their coloring powers, while again others, alike in their tints, on examination exhibit a very great difference.

On looking further into this table, we find that as yet no difference has been established in the coloring powers of Java and Bengal indigo, for in commerce both high and low qualities, as well as high and low prices, are obtainable for indigo from these two sources.

Carakas and Kurpah indigos are generally somewhat less rich in coloring matter than those from Java and Bengal, although their lesser value causes them to be often more profitable than the last mentioned.

We also find, that the best and dearest indigos from Java and Bengal are for the consumers in general less profitable than the inferior qualities; this case however is different with Carakas and Kurpah indigos, the better and highest priced kinds yielding more profit than the lower qualities.

Indigos from Guatemala Flora, Madras, the Philippines, Manilla, and Bombay, which Schlumberger examined, are with reference to their price much weaker, consequently less profitable than the product of Java, Bengal, Carakas, and Kurpah.

Sulphuric acid disengages from different kinds of Manilla indigo carbonic acid, seeing that these contain carbonate of lime.

It frequently occurs that the commercial indigo of Java is not assorted, and that the one and the same chest as has been

seen by the foregoing table, contains qualities which differ as much as 28 per cent. with each other; the same fault takes place, although in a less degree, with Carakas and Kurpah and other indigos.

Consumers must endeavor to set aside an abuse of this kind, and refuse the purchasing of indigos that are not properly assorted, for to them the loss may be considerable, not only in reference to the price, but hereafter when used as a dye.

There are also occasions on which the preference may be not undeservedly given to those indigos which offer the most favorable chances of profit with respect to their coloring powers and price; seeing that with some consumers of this drug, better results are obtained with one kind.

Indigos, coming from different sources, are prepared in different ways; it follows therefore, that the impurities which may affect the blue coloring matter, as far as concerns their quality and quantity, may differ very considerably. These foreign particles therefore may be of great influence over the substances, which, in connection with the indigo are made use of by the dyers, seeing that they for instance assist in the working of the deoxydization of the blue coloring matter in a longer or shorter space of time, or tend more or less to the speedier dissolution of the same.

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OF

INDIA.

A Brief Summary of Major Cautley's Project for Irrigating the Dooab from the Ganges.

[Communicated by the Government N. W. P.]

To the Honorary Secretary Agricultural Society: Calcutta.

Revenue Dept. SIR,—I am directed by the Honorable the Lieutenant Governor to acknowledge the receipt of your letter, dated the 22nd ultimo, and in reply to forward, as therein requested, the accompanying copy of a summary of Major Cautley's project for irrigating the Dooab from the Ganges, drawn up by Captain Baker.

2. I am also directed to observe, that His Honor will always have much pleasure in placing at the Society's disposal any papers which are likely to be of use in forwarding the important objects which the Society have in view.

I am, &c.

Agra: J. THORNTON,

The 13th August, 1846. *Secretary to Govt. N. W. Provinces.*

The Dooab is a belt of country about fifty miles wide and 450 miles long, measured centrically from the foot of the Sewalik hills to Allahabad. It is bounded by the deep valleys of the Ganges and Jumna, and subdivided into numerous minor belts by other rivers, each having its own valley or depression, and running a course generally parallel with the boundary streams.

General features of the Dooab.

2. In this tract of country, there is an uninterrupted slope in the direction of its length, or from the hills towards the sea, and each of the minor belts or subdivisions not only partakes of the general longitudinal declivity, but has its own cross slope right and left, from a central higher ridge to the subdividing valley on either side of it.

Slope or profiles of the country.

3. A central high ridge is also found to traverse the length of the Dooab, passing between the heads of the rivers which drain respectively into the Ganges and Jumna, and affording access without any intervening depression to the subordinate ridges above alluded to.

Central ridges connecting the junior ridges.

4. From this general description must be excepted the tract of country between the Jumna and Hindun, a great part of which being already watered from the Jumna by the Dooab canal, may be left out of consideration at present.

Exception to the above description.

5. The remaining portion of the district, such as it has been described, is evidently most favorably situated for irrigation. A main trunk canal, running throughout the length of the Dooab and carried along its central ridge, would throw off branches to be introduced at the heads of the several minor subdivisions, and which being conducted along their highest ridges, would afford facilities for irrigating the whole surface. The supply of this main trunk is therefore the problem to be solved.

Facilities for irrigation.

6. The means of extensive irrigation can be derived only from the Jumna and Ganges, which, rising in the snowy ranges of the Himalaya, draw their waters from an unfailing source. The other rivers, or more properly drainage channels, which intersect the Dooab, are supplied merely by the rain that falls on the surface of the country, and many of them are dry during the greater part of the year.

The Ganges and Jumna alone for irrigation.

7. The stream of the Jumna is already appropriated to the Delhie territory and the tract of country west of the Hindun, and though the more abundant stores of the Ganges have hitherto been untouched, the hope of rendering them available for the required purpose found little encouragement from the first examination of the relative levels of that river, of the high lands of the Dooab, and of the intervening tract of low land. The details of the subsequent inquiry will be found in Major Cautley's printed reports: it is sufficient here to state, that the persevering and skilful exertions of that officer were at last rewarded by the discovery of practicable lines, not indeed unattended with difficulties, but by which he has satisfactorily shewn, that the whole volume of the Ganges might be delivered at the head of the cultivated districts of the Dooab.

The Jumna already appropriated; the Ganges, may, with difficulty, be made available.

8. In order to obtain water at the required level, it was necessary to take it off from the Ganges at the place where that river debouches from the Sewalik hills, near the town of Hurdwar, between which and Roorkhi, on the high land of the Dooab, (a distance of nineteen miles,) the difficulties alluded to in the last paragraph are chiefly met with.

Necessity of establishing the head at Hurdwar.

9. The canal will here pass over a tract of undulating ground, known by the local name of the "Ganges Khadir," and will cross the drain-

And for passing the Ganges Khadir.

age of a long tract of the Sewalik hills, either spread over the country or collected into principal lines or channels, nearly dry for three parts of the year, but assuming a formidable aspect during the periodic rains.

Calculation of the quantity of water required.

10. Further details of these difficulties, and of the means by which Major Cautley proposes to overcome them, will appear more appropriately in the general summary of his project for the Ganges canal: but before entering on this subject, it may be proper to estimate as nearly as possible, what quantity of water would be required for the irrigation of the whole surface of the Dooab, and what proportion of that quantity could be spared from the Ganges.

Calculation based on the results of existing canals.

11. As the basis of this estimate, it will be more satisfactory to take the ultimate results of the existing irrigation canals in the North Western Provinces, than to attempt a calculation of the quantity of water required to moisten a given surface, and of the loss by evaporation and absorption in a given length of water course, all which circumstances depend so much on the accidents of soil and climate.

Standard of comparison, a certain pergunah in the Delhie territory.

12. We assume therefore, as the standard of comparison, a certain pergunah (Soneput Bangur) in the Delhie territory, which has for a long time possessed every facility for canal irrigation, and of which the agricultural statistics have been accurately ascertained by the Revenue Officers engaged in the late settlement. It appears that in this district about one-third of the whole area is irrigated from the canal, and though the proportion might doubtless be increased with profit to the inhabitants, it would scarcely be advisable to do so, out of a limited supply of water, considering that the amount of irrigation already engaged, enables the cultivator to pay the Government dues, affords him ample subsistence, and makes him, in a great measure, independent of the seasons.

13. The Bangur or high land of the Dooab, bounded by the Jumna and Hindun and the Ganges, is assumed by the Committee on the Ganges Canal (vide their printed report) to comprise 8,620 square miles, one-third of which, or 2,873 square miles would, on the above assumption, require irrigation.

Extent of land required to be irrigated.

14. It appears further, from data detailed in the printed reports, that an average discharge of one cubic foot of water per second throughout the year, is sufficient to irrigate 350 beegahs of fifty-five yards square; in other words, that one square mile would require a discharge of 2,926 cubic feet per second, and that 2,873 square miles would require 8,406 cubic feet per second.

Quantity of water required for a certain area of land.

15. The quantity of water which the Ganges canal is calculated to discharge, is limited to 6,750 cubic feet per second, (equal to the irrigation of 2,307 square miles,) a quantity which would appear from the above calculations to be insufficient to meet the entire requirements of the Dooab, but which would amply supply the branches provided for in Major Cautley's 3rd project, in which the irrigation of the country between Futtehpore and Allahabad, and of other tracts specified hereafter, are not provided for.

Estimated discharge of the canal sufficient to supply the proposed length of canal.

16. It is probable, however, that the assumed standard of comparison is too high, and that the irrigation of one-fourth of the area of the high lands of the Dooab, would afford the country a sufficient security against the effects of drought. This would reduce the requirement to 2,155 square miles, a quantity within the capability of the proposed canal to supply.

And probably sufficient for the whole of the Dooab.

17. The following is a brief summary of the project as detailed in the printed reports:—

Summary of the project.

18. The head of the proposed canal will be established in the right and west bank of the Kunkhul branch of the Ganges, about one and a quarter mile below the famous bathing ghats of Hurdwar. The supply of this branch, though at present insufficient for the wants of the canal, can be indefinitely increased by means of gravel bunds at the point of its separation from the main stream of the Ganges, from which point, to the head of the canal, the present irregular dimensions, and slope of the channel, will be reduced to uniformity.

Position of head of canal and supply channel.

19. The head regulator will consist of a bridge over the canal, connected by a rivetment wall, with a dam across the Kunkhul branch. Both these works will be furnished with wooden sluices, by means of which the supply of water will be regulated, and may be excluded altogether from the canal when not required.

Description of head regulator.

20. The excavated channel of the canal from the head to the fiftieth mile (where the head of the Futtehgurh branch will be established) will have a bottom breadth of 140 feet, and side slopes varying with the depth of cutting. The fall or slope of bottom will be four feet in the first two miles, and subsequently one and a half foot per mile, being the greatest which is considered consistent with the stability of the canal bottom, in ordinary soils and with a large volume of water.

Excavated channel, dimensions and slope.

21. The declivity of the country, however, is much in excess of that proposed to be given to the canal, and a necessity therefore arises for disposing of the surplus slope, which is effected by means of masonry falls (to be specified hereafter) by which the canal is let down from a higher to a lower level, on a massive platform of masonry.

Mode of disposing of surplus slope.

22. In the first five miles the canal crosses three lines of hill drainage—the first is admitted through a masonry bridge or inlet above the regulator, and will pass off into the Ganges, the other two will enter the canal through similar inlets, and being small in volume, will flow along the canal channel as far as a mountain torrent occurring at the fifth mile, and called the "Ranipoor Rao."

Three lines of drainage, and provided for by inlets.

23. This is the first serious obstacle, and as it pours down, during floods, too large a stream of water to be absorbed in the canal channel, a special provision is made for its escape by means of a masonry dam, furnished with sluice planking, the removal of which would allow free passage to the floods, and its use (on ordinary occasions) would retain the water in the canal; the applicability of such a work to the required purpose has been tested by long experience on the existing canals.

Description of dam over the Ranipoor Rao.

24. A few miles further in advance, the canal will descend into the valley of the Putthro, another line of hill drainage, by two masonry falls (such as above described) at the village of Bahadurabad, with attached locks. The drainage of the valley, which is considerable, will be disposed of by two minor inlets and a principal dam, similar to that on the Ranipoor Rao.

Mode of crossing the Putthro valley.

25. The falls at Dhunowree, similar to those at Bahadurabad, will deliver the canal at the level of the Rutmoo valley; the third principal line of hill drainage, and more considerable than the two preceding.

Dhunowree falls.

26. A dam similar in principle, but of larger dimension, will here be required, but will be attended with a disadvantage from which the others are comparatively free. At the point where the canal crosses the Rutmoo, the level of the latter will be very nearly that of the canal bottom on which (with a full supply in the canal) there will be a depth of ten feet water, and the consequence

Rutmoo dam and foundation.

will be an extensive inundation for about one and a quarter mile up the valley of the Rutmoo. It will be the care of the Executive Engineer to circumscribe the limits of this inundation as much as possible by embankments, but no complete remedy for the evil has yet suggested itself, save by an expenditure of nearly a lakh of rupees.

Regulating bridge.

27. To the Rutmoo dam will be added a regulating bridge, similar to that at the head, to prevent the admission of too much water on the Solani aqueduct, and to obviate the chance of trees, &c., being drifted upon that work.

High land of Peeran Kulleeur.

28. After passing through the Rutmoo in the manner above described, and over a small separate line of drainage by means of a tunnel, the canal enters upon an isolated or rather peninsulated tract of high land, on which stands the village of Peeran Kulleeur. The cuttings for two miles will be deep, but cannot be avoided, save by a circuitous detour, which would involve greater expense. The earth moreover will be required on one side for the Rutmoo embankments, on the other for the Solani aqueduct.

Valley of the Solani river.

29. The valley of the Solani is at this point about two and a half miles in width, and in depth averaging sixteen and a half feet below the level, at which it is necessary to carry the canal bottom, in order to deliver it on the high land of the Dooab. On the east side of the valley is a small channel, which receives merely the local drainage. On the west is a wide sandy bed, carrying a small perennial stream, but subject to freshes of extraordinary magnitude.

Country drained by the Solani.

30. The extent of country drawing into the Solani is estimated by Major Cautley at about 140 square miles, comprising a length of eight miles of the first range of the Himalaya, sometimes called the "Sewaliks." The geographical position of these hills subjects

them to heavy falls of rain, which running off immediately from their stony soil and precipitous sides, occasion sudden floods of short duration but extreme violence.

Necessity for an aqueduct.

31. The required height of the canal, and the great depression of the valley, prescribe the mode of crossing it, which can be best effected by an aqueduct or raised channel, carrying the canal at the required height, and allowing a free passage underneath for the floods of the Solani.

Description of earthen portion of aqueduct.

32. The details of the proposed work are as follows:—

The small drainage channel, east of the valley above mentioned, will be diverted by a cut into the main channel, and a continuous mound or embankment will be constructed across the valley from the high land of Peeran Kulleeur, to near the present course of the stream. The top of this mound will be formed into a channel of the prescribed dimensions, the side slopes of which will be further protected by a facing of masonry in steps, whose foundations will be carried down through the made earth into the natural soil.

Masonry portion of aqueduct.

33. In continuation of the earthen mound and where the main stream of the Solani now flows, will be constructed the masonry aqueduct, carrying the canal in two channels, each eighty-five feet wide, and allowing a passage for the river below through fifteen archways of fifty feet each. The piers and abutments of this work will be founded on blocks or masses of masonry, twenty feet broad, and undersunk by a process well known in India to a depth of twenty feet.

Nature of soil and protections of foundations.

34. The soil down to and beyond this depth, consists of sand interspersed with clay, a description of soil well able to support the mass of masonry if secured from the risk of displacement by the action of water. This security will be obtained in the present

struction of counter-arches in each waterway, and the addition of front and rear floors of coarse masonry, thirty feet wide each, bounded by a continuous line of piling, twenty feet deep.

35. The above mentioned precautions would probably suffice, but in the opinion of the present director of the works, it would be worth the expense, (viz. 28,800 Rs.) to connect the foundation blocks both in front and rear by certain walls, eight feet thick, sunk simultaneously with the blocks and by the same process to twenty feet.

A further precaution recommended.

36. The masonry aqueduct will be connected to the westward with the high land of Koorkhi, by a portion of earthen aqueduct, similar in every respect to that already described.

Connection of aqueduct with the high land.

37. The ultimate stability of the aqueduct depends not more on the security of its foundation than on the sufficiency of its watering to pass the floods of the Solani, a point regarding which much anxiety was felt by the projector.

Sufficiency of the watering considered.

38. During the first few years of Major Cautley's acquaintance with the Solani, the floods were moderate, not indeed reaching the height which local tradition had led him to anticipate. He therefore provided for what he had reason to believe, a maximum flood by ten waterways of fifty feet each, but was subsequently led to increase the number to fifteen, by the occurrence of an extraordinary flood in 1844.

Floods moderate up to 1844.

39. That this flood was really an extraordinary one (and therefore not likely to be much exceeded in future) is fully proved by the circumstance that several village sites were submerged by it. We may fairly presume, that few people having a choice of higher ground would build their houses on spots *supposed* to be subject to overflow.

The flood of 1844, extraordinary.

40. The present director of the works having passed the last rainy season at Koorkhi, had full opportunity of watching the floods of the Solani, and one in particular, which, though not equal to the flood of 1844, was considerably above the former average. An accurate section of this flood was taken, and from it was deduced that of 1844, whose relative levels were known. The calculated result shewed that the waterway of the aqueduct as now proposed, is greater than the section of the flood in 1845, and little less than that of 1844, so that had the aqueduct then existed, the afflux or rise on the up stream side of the work would have been inconsiderable.

Section to a flood, 1845, accurately measured.

41. It is therefore probable, that the waterway first projected would have been found sufficient, but the addition now proposed will place the work beyond all risk of accident from this source.

Waterway now provided, stated to be ample.

42. It is here proper to mention, that the necessity for a masonry aqueduct across the Solani valley may be altogether avoided by following a circuitous route, and crossing the valley where its levels would admit of the drainage being dealt with in detail by dams, similar to those proposed for the Putthro and Rutmoo.

Aqueduct avoidable by a circuitous line.

43. In the original cost of this, compared with the direct line, a saving of ten lakhs of rupees might be effected, but the increased annual cost of establishment on a line of five additional dams, with the probably frequent expense of repairing them, and the far greater risk of interruption to the canal supply by accidents to these works, induced both Major Cautley and the Committee appointed to report on his project to give a decided preference to the direct line.

Circuitous line more economical, but rejected on other considerations.

44. From the Koorkhi onwards through the Dooab, no obstacle of consequence is met with, the excavated channel will retain the dimensions before mentioned as far as the fiftieth mile. The slope

Excavated channel beyond Koorkhi.

of the canal bottom will be uniformly one and a half foot per mile, and will be accommodated to the greater slope of the country by masonry descents similar to those above described.

45. The considerations which will be principally had in view, in permanently fixing the line of canal, are briefly these:—

Considerations had in view in lining out the canals.

I. To keep the canal as much as possible on the highest ridge, so as to facilitate the distribution of water for irrigation, and not to interfere with the drainage of the country.

II. To insure a depth of cutting which will provide earth sufficient for the requisite embankments, and keep the canal nearly, if not entirely "*within soil,*" i. e. that the surface level should be as little as possible above that of the country.

III. To keep the canal as much as possible in straight lines, and when a curve is unavoidable, that it should be of not less than two miles radius.

46. Where the third of these conditions is incompatible with the other two, *they* are made to give way. The importance of a good alignement appears paramount with reference both to the maintenance of a centrical set of currents in the canal, and to the probability that one of the canal banks may hereafter form the basis of a railway, whose direction if intended to traverse the length of the Dooab, would be guided by nearly the same considerations as that of the canal.

A nearly straight alignement of paramount importance.

47. Bridges for the cross communication of the country are provided at every third mile, their waterways being proportioned to the width of the canal at their site, and their roadways having a uniform clear width of fifteen feet between the parapets.

Road bridges.

48. From near the fiftieth mile, a branch canal will be led off in the direction of Futtehgurh, turning the head of the east Kallee river. The main trunk with its bottom breadth diminished to

Head of Futtehgurh branches, and escape outlets.

130 feet, and subject to a further gradual diminution of one foot in every three miles, will proceed between the east Kallee and the Hindun, passing close to Sirdhana, and eight miles westward of Meerut. A few miles north of Sirdhana there will be an escape into the west Kallee, the object of which is to enable the Superintendent to regulate the canal supply or to reduce it, on emergency, such as a breach in the embankments. A similar work will be constructed at the eighty-sixth mile, to be connected with the Hindun, the level of which and of the west Kallee being considerably below that of the canal, is favorable to these very necessary works.

Navigable communication with the Hindun practicable.

49. A navigable communication between the canal and the Hindun, opposite the town of Dasnab, is shewn by Major Cautley to be feasible, but the cost has not been estimated.

Head of the Boolundshuhur branch and Koorjah escape.

50. At the 110th mile, the Boolundshuhur (called in the Committee's report the Tuppul) branch will leave the canal passing westward of the Karoon river. The main trunk, now reduced to 108 feet bottom breadth, will have an escape into the east Kallee at Koorja, and passing north of Allyghur, and along a narrow ridge between the east Kallee and the heads of the Rinde and Seyngoor rivers, will follow the high land which divides the drainage of the Rinde and Eesun, and continue for a long distance along the narrow belt which lies between these two rivers.

Head of the Etawah branch and escape.

51. Beyond the 180th mile, which is the point of separation of the Etawah branch, the canal will have a bottom breadth of eighty-nine feet, and a slope diminished to one and a quarter foot per mile, as far as the 250th mile, to suit the slope of the country, having also an escape into the Eesun at Hussunpore.

Three projects proposed.

52. Beyond the 280th mile, three projects are put forward by Major Cautley.

53. The first providing for an irrigation branch towards Cawnpore between the Pandoo and Eesun, and a main navigable line, with a flowing stream to Allahabad, where it would be connected with the Jumna by a series of locks. The levels on this line are unfavorable and would require the canal to be carried at a depth below the surface, which would render irrigation impossible except by machinery.

The first provides navigation to Allahabad, but sacrifices irrigation; rupees 1,02,36,643 : 14 : 11.

54. The second project also provides for a direct communication with Allahabad, and avoids the deep excavation by substituting a series of reservoirs connected by locks for the flowing stream of the first project. These might be more favorable for navigation, but are liable to many serious objections, and would not be more favorable to irrigation than the first project. The water would indeed be maintained at a higher level, but the small quantity that would find its way along the nearly level channel, would all be required to supply lockage and wastage.

The second provides for the same objects at less cost, but is otherwise objectionable; rupees 97,03,558 : 2 : 9.

55. The third project as being the most eligible, unless navigation be considered a primary object, may be described in greater detail.

The third project most eligible; rupees 93,39,746 : 12 : 6.

56. At the 280th mile, the canal will divide into two navigable branches, one connected with the Ganges at Cawnpore, the other with the Jumna at Jar. The Jumna line, with a slope reduced to fourteen inches per mile, and a bottom breadth of forty-five feet, would pass between the Pandoo and Rinde rivers, keeping close to the latter in order to avoid a low and difficult tract of country drained by three nullas, the Syaree, the Choya, and the Soofa, which will be crossed by aqueducts near their junction with the Rinde—a minute examination of the country having shewn this to be the line liable to the least objection. The line will then pass southwest of the

Navigable communication with the Jumna.

cantonments of Cawnpore, at a distance of nine and a half miles, and at the 360th mile will turn off from the straight direction on Allahabad, and following a course parallel with the Rinde, will communicate by a series of locks with the Jumna, which is navigable from Allahabad up to this point.

57. The Cawnpore or Ganges branch, separating as before mentioned at the 280th mile, will be carried along the high land, dividing the drainage of the Eesun and Pandoo, and will be connected by a series of locks with the Ganges at Cawnpore.

Navigable communication with the Ganges.

58. The adoption of the third project would appear at first sight to deprive the Futtehpoor and Allahabad districts of irrigation, which the direct line to Allahabad, forming part of the first and second projects, might be supposed to afford, but the previous remarks on those designs show, that this objection exists in appearance only.

3rd project scarcely less favorable than the 1st and 2nd, to the irrigation of Allahabad.

59. The lines for the Futtehgurh, Boolundshuhur, and Etawa branches, have not yet been finally determined, nor can they be so, until after a minute examination of the ground. The same general principles, as have been before detailed, will guide the Executive Officer in choosing his alignements; and though facilities for navigation will be afforded, as far as water may appear likely to be available, irrigation will be considered the primary object.

Branch canals not yet lined out.

60. The execution of either of the above projects will leave two tracts of land unprovided with irrigation, viz. between the east Kallee and Eesun, and between the Seyngoor and the Jumna. Additional branches would probably be required for these tracts, but may be safely deferred until the other branches having come into full operation, it will be seen whether there is any surplus water to meet new demands.

Two portions of the Dooab unprovided with irrigation.

Flour mills proposed.

61. The project further provides for the construction of flour mills wherever water power is available in suitable localities. The principal will be at Hurdwar, Kunkhul, Koorki, Cawnpore, &c.

Mode of distribution of water for irrigation by 'Rajbuhas.'

62. The system, which it is proposed to adopt on the Ganges canal, for distributing the water for irrigation, is that which the experience of twenty years on the existing canals has shown to be the best, viz.—that of 'Rajbuhas,' or joint stock watercourses, consisting of a main channel from the canal, dug under the direction of the Superintendent at the joint expense of several villagers, and throwing off such branches as may be required in passing the lands of each share-holder. The advantages of this plan over that of having a separate watercourse for each village are, saving of water and expense in excavation, prevention of disputes where the water for one village has to pass through the lands of another, and giving the Superintendent a more efficient control over the supply.

Extent over which water may be distributed.

63. By means of a system of 'Rajbuhas,' the water can be distributed through a width of seven or eight miles on each side of the canal, and even to a still greater extent if required.

Estimated pecuniary returns from the canal.

64. Assuming the cost of the canal at one crore of rupees, Major Cautley assumes, on well considered data, that the annual return will eventually be rupees 14,25,000 : 0 : 0, (14¼ lakhs per annum) : that the annual cost of maintenance and establishment will be about four lakhs, leaving a balance of ten and a quarter lakhs, or ten and a quarter per cent. per annum on the original outlay.

Injury to the navigation of the Ganges how compensated.

65. It is admitted that the obstruction of the canal supply may interfere with the navigation of the Ganges above Cawnpore for six months in the year; the amount of inconvenience from this source has not been accurately estimated, but it is evident that the substitute for this navigation which will be afforded by the

canal itself, will have the advantage of expedition, and immunity from risk by storms, (and therefore from the necessity of insurance.) The canal toll would be levied with reference to these advantages, but leaving a balance in favor of the canal over the river route.

Question of insalubrity under investigation.

66. The question whether canal irrigation is insalubrious, being now under investigation by a Special Committee, need not be here adverted to.

(Signed) W. E. BAKER, *Captain,*
Director, Ganges Canal Works.

Report on the culture of Wheat at Broach in the season 1843, *by Dr.* A. BURN, *Superintendent of Cotton Experiments: with a subsequent Correspondence regarding the shipment and sale of the produce in the Liverpool market.*

[Communicated by the Government of Bombay.]

To the Secretary to Government, Territorial Department, Bombay.

SIR,—I have the honor to transmit a report on the experiment of wheat cultivation for the information of the Hon'ble the Governor in Council, accompanied by a debit and credit account, showing the expenses and returns on the whole. The actual pecuniary returns, however, it will be seen, cannot be ascertained until the sale of the wheat sent to Liverpool.

2. Attached also is a list of the prices of wheat in the Broach market during the last ten years, which may be interesting. It clearly shows a gradual and very great falling of price down to the present time, and this it is hoped may be attributed to the improved security of property, and extension of cultivation over the country, which, if the case, must naturally lead to the conclusion, that wheat can be raised here by the natives at a sufficiently remunerating price to admit of export to England, the only difficulty to be dreaded being the "weevil" injuring the cargo on board ship, and for which,

in all probability, a remedy can be found were inquiry and experiment directed to it. I apprehend difficulty only in case of the insects not confining themselves to wheat alone, but being found on board of all ships, in parts of their cargoes.

3. In concluding, I beg to express my regret at the length of time which has elapsed since Government called for this report. I have used every exertion which the state of my health, together with other duties, would admit of, and still it is far from being so full and complete as I wished it to be; as the Chamber of Commerce have shown so much interest and attention to the question of exporting wheat, and in this case taken charge of the investment, I should feel obliged by Government allowing a copy of my report and accompanying documents to be presented to it.

I have the honor to be, &c.

Broach : (Signed) A. Burn,
23rd September, 1844. *Superintendent Cotton Experiments.*

Report.

Owing to the unusually heavy monsoon at Broach in 1843, a large portion of land under cotton cultivation was thrown out of culture, the plants being rotted and injured by the excess of moisture, and as the land must, from this cause, have lain for the season unproductive, it was thought better to follow the usual practice of the country of ploughing it up, and sowing another kind of crop. Accordingly, application for leave to try a crop of wheat was made on the 3rd of October, through the Chief Secretary to Government, and permission obtained. The work people were then set to work, and forty-six beegas, or about twenty-three acres of land, were ploughed up and got ready to be sown in rows of thirteen inches apart, by the means of the common native wheat drill, which sows two rows at a time. The sowing commenced on the 14th and was finished on the 19th of November. From the completion of sowing till the crop is ripe, no hoeing or work of any kind is necessary, the plant growing during the cold season of the year: it requires also no rain, for from the ingenious method practised by the natives of having prepared a loose and fine surface, six to eight inches in depth, the subsoil into which the seed is skilfully put by means

of the drill machine, retains sufficient moisture to admit of the plants growing and yielding produce, but which of course bears a proportion much in accordance with the climate of the season, as well as the care bestowed in preparing the soil. In the present instance the grain was ripe on the 6th of March, and by the 15th it was all reaped: thus giving, as nearly as possible, a period of four months as necessary for maturing the crop.

2. The quantity of seed wheat required was 1,569lbs., which, as the land sown was forty-six beegas, gives a rate of a little above 34lbs. to the beega. And as 100 Broach beegas may be taken as equal to fifty-one statute acres, the beega may, for ordinary calculations, be allowed to stand for half an acre,—then the rate per acre will be 68lbs. The total produce amounted to 17,065lbs., which gives a rate of 371lbs. per beega, or 742 per acre, and taking the bushel at 60lbs., then 12 bushels and 22lbs. per acre. A little more than half the average yield of English wheat-fields, supposing their average to be 22 bushels.

3. From the figure statement No. I. of receipt and disbursement attached, it will be seen, that the charges of cultivation amount in all to Rs. 532 : 10 : 3, which gives a rate of cost per beega, the land rent included, of Rs. 11 : 9 : 3, or per acre of Rs. 23 : 2 : 6. The charge for rent furnished by the collector amounts to Rs. 204 : 7 : 9, and gives a rate of Rs. 4 : 7 : 1 per beega, or twice this per acre; and as the balance, Rs. 328 : 2 : 6, included all the other expenses of culture, the rate of these will be Rs. 7 : 2 : 1 per beega.

Rs.	532 : 10 : 3
	204 : 7 : 9
	328 : 2 : 6

4. A portion of the produce was disposed of at Broach; it consisted of the inferior wheat and chaff, and is set down at Rs. 59 : 14 : 8, and if the superior quality produce had been sold in Broach, in place of being shipped to England, its value could not, during the past season, have realized above Rs. 10 per kulsi. At this rate, the sum received, would have been for "kulsis" 21:12:30, and amounts to Rs. 217 : 15 : 6, giving Rs. 277 : 14 : 2 as the value of the whole produce. This gives a rate per beega of Rs. 6 : 0 : 8 only, as the value of the produce, and therefore exhibits a loss of Rs. 5 : 8 : 7 on the rate of cost for cultivation,

Rs.	59 : 14 : 8
	217 : 15 : 6
	277 : 14 : 2

Rs.	11 : 9 : 3
	6 : 0 : 8
	5 : 8 : 7

Rs. 532 : 10 : 3	and upon the total expenditure Rs. 254 : 12 : 1,
277 : 14 : 2	supposing all the produce disposed of at
254 : 12 : 1	Broach.

5. One of the objects had in view from the commencement of this experiment was, the shipment to England of a portion of the produce, that some definite information might be obtained on the feasibility of making wheat an article of export from this part of India. Attempts, it is said, had previously been made, but almost invariably failed of success, owing to the grain being destroyed on the voyage by an insect called "the weevil." The natural history of the insects causing this injury appeared little understood, and it was hoped to gain some useful information in reference to them, which might ultimately lead to beneficial knowledge of practical application. Further, it was thought, that provided the grain was packed up in small bags, and shipped off from this country as soon after it was ripe as possible, and without being allowed to come in contact with grain of the previous season's growth, and which is almost all more or less infected, that it might possibly, in this way, be preserved from the attack of the weevil. The insects it could hardly be supposed existed originally in the grain; or were the offspring of a spontaneous generation; and if so, then but two sources remained from whence they could originate. That is, either by allowing too close an approximation of the fresh wheat to the old grain-stores and produce; or that the insects existed on other substances besides wheat, and might therefore be found on board the vessel in which it happened to be a part of the cargo. In reply to a letter dated 25th March 1844, Government allowed a portion of the wheat to be intrusted to the care of the Chamber of Commerce at Bombay, for shipment to England. The quantity sent amounted to nearly thirty quarters. It was carefully packed and sewed up in 233 bags, of double gunny cloth, each holding about 61 lbs. weight, and was shipped from Broach on the 5th of May, and arrived at Bombay without suffering any injury except to three bags, as noticed in the letter of the Secretary Chamber of Commerce, No. 86, of 17th August 1844, copy of which is here attached. As the different charges for packing and shipping at Broach are all entered in the debit and credit statement, they require no particular notice here. The whole amount is Rs. 98 : 6 : 7.

6. At Bombay, the charges are for landing, and re-shipping, insurance, and policy; they amount to Rs. 53 : 8 : 0. The freight to Liverpool is payable on arrival there, and for the present purpose may be taken at Rs. 215 on the whole.

7. It has been shown in paragraph No. 4, what proportion of the crop was sold at Broach, and the value received for it. The balance shipped to Liverpool must therefore bear the remaining portion of the expenses incurred on the produce. This amounts to Rs. 472 : 11 : 7; and as all the charges attendant on the various stages of the experiment have now been given, the following tabular statement is attached to show the rates of each, and what will be the cost per "kulsi" and per quarter, on the grain, laid down at Liverpool.

Wheat grain, rate of cost.	Per kulsi 656lbs.			Per quarter 480lbs.		
Cost of Cultivation, ...	21	11	$0\frac{1}{4}$	15	13	11
Ditto packing and shipping from Broach to Bombay, ...	4	8	$2\frac{3}{4}$	3	4	$10\frac{1}{4}$
Ditto re-shipping, insurance, &c., at Bombay,	2	7	$3\frac{1}{4}$	1	12	$8\frac{3}{4}$
Ditto freight from Bombay to Liverpool, ...	9	13	$9\frac{3}{4}$	7	3	6
Total Co's. Rs.	38	8	4	28	3	0

8. If the above sums be correct, then 56 or 57 shillings per quarter (the rate of exchange being two shillings) will be about the cost of the grain in Liverpool, duty unpaid. It remains, however, to be inquired what the nature of the different charges on the investment have been, before any fair conclusion can be arrived at, as to profit, in case of wheat being proved a suitable export from this part of India. Experiments generally, are very expensive, and it is natural they should be so, until experience has taught the curtailment and reduction of whatever is unnecessary, and the appreciation and economic application of all that is essential, and no more than is required to bring out the best results. It cannot be presumed that in the present instance, economy was carried to its utmost, far from it; indeed the contrary may be assumed, as nearer to the truth, and without any censure on the care and attention bestowed by the experimenter. Agricultural operations in this climate require so much to be left at the mercy of, and to the conscientious discharge of the

native inhabitants; and who naturally feel little interest in the results only in the continuance of the daily or monthly wages for which they are hired. As is the case all the world over, when the cultivator has a direct interest in the value of the crop he is raising, there is no doubt he bestows far more care upon it than if merely hired to attend on it, as in the present case. But there are various other influences unnecessary to be noticed here, which tend to raise the cost of production to a stranger attempting cultivation of any description by means of hired labor in this country. As the results of this present experiment exhibit a loss on the cultivation valued by the local market rate, it must also be interesting to inquire, how it is that the native cultivators manage to live, and pay their rents under similar circumstances? It is presumed that the rate of produce from the surrounding fields and district may be taken at about the same as is shown above, and as the market value of the produce was probably similar, it naturally follows that if one party is a loser, and the other not, that a difference must exist in the relative charges of production, which fall to be defrayed by the different parties. Accordingly, it will be found, that the native cultivator has no pecuniary charge for laborers, himself and family do the work of the field, and he can borrow assistance from his neighbor, who may have no wheat field, but has one of rice or cotton, or something requiring labor reciprocated at a different time of the year. Implements and cattle are stock of his own. The former costing merely a trifle, and maintained by the village carpenter at a small annual charge, generally paid in kind. The latter consist of a pair of bullocks, reared probably in his own family, sheltered when necessary within the same mud hovel as himself, and as the waste places and headlands round the cultivated fields yield abundance of grass during a large portion of the year, the cattle are there carefully tended, and thus together, with the straw from his grain field, of whatever kind that may be, little or no expense is incurred in the purchase of fodder. On reference to the different heads of disbursement set down in the accompanying statement, it may be fairly estimated, that the native cultivator would sustain, in general, very little charge on those numbered, 2, 3, 4, 5, 7, and 9, himself and family supplying this portion, which amounts in value

to Rs. 299 : 0 : 6, and leaves a balance of Rs. 233 : 9 : 9 under the heads numbered 1, 6, and 8, to be discharged in cash, just showing a balance profit to him, at the present market rates, of Rs. 41 : 4 : 5. It then appears, that the expenses of cultivation in this experiment have exceeded those of the native by Rs. 32 : 11 : 4¼, the cost of labor being exactly so much more than half of the whole charges. Thus ten rupees per kulsi, although it admits of but a small profit to the native cultivator, would allow of the grain being landed in Liverpool, all the other charges and rates remaining as formerly set down, at Rs. 26 : 13 : 3¾ per "kulsi," or Rs. 19 : 10 : 2 per quarter; and which is a very material reduction on one of the charges, apparently bringing the article, so far as cost only is concerned, well within the limits of a suitable export.

9. Attached to this paper is a statement showing the prices of wheat in the market of Broach since 1835, and from which the average wholesale price has been deducted up to this time, or on the past ten years at Rs. 16 : 11 : 7 per kulsi, or per quarter 12 : 3 : 9½. This would give the cost laid down in Liverpool, the other rates and charges being the same as set down above, at Rs. 33 : 8 : 10¾ per kulsi, or Rs. 24 : 8 : 10½ per quarter, and which still seems not too high for exportation.

Broach : (Signed) A. Burn, M.D.,
21*st September*, 1844. *Superintendent Cotton Experiments.*

Dr. { *Statement showing the amount of Expenses and Receipts on account of Wheat Cultivation at the Farm of Karode, in the season* 1843-44, *also Package and Shipping of produce from Broach to Bombay, and from Bombay to Liverpool.* } *Cr.*

Receipts.

	Rs.	As.	P.	Rs.	As.	P.
Sold Wheat at Broach, the inferior quality, 2 kulsis $5\frac{1}{4}$ maunds, @ Rs. $7\frac{1}{2}$ and 1 kulsi $1\frac{1}{4}$ maunds @ $7\frac{1}{4}$ per kulsi, ...	31	2	8			
Sold "Gotur" or wheat chaff, 8 kulsis 9 maunds, ...	10	12	0			
Value estimated of "Gotur" remaining as food for the farm cattle, ...	18	0	0			
				59	14	8
Balance remaining to be recovered, value of Wheat shipped from Broach, as per invoice list 6th May 1844, net weight 127 cwt. 2 qrs. 18lbs., gross 131 cwt. 3 qrs. 8lbs. in 233 bags, ...	..			839	10	2
				899	8	10
Carried over Co's. Rs.				899	8	10

Disbursements.

No. I.—*Particulars of expenses incurred on Wheat Cultivation at Karode.*

	Rs.	As.	P.	Rs.	As.	P.
1. Seed Wheat 38 maunds and 11 seers @. Rs. 9 per kulsi, including cooly hire and carriage, Rs. 6 : 9 : 6, ...	28	2	0			
2. Laborers, extra, hired for cultivation, ..	47	0	6			
3. Ploughs 54, extra, hired @ 8 annas each,	27	0	0			
4. Hoes, bullock, 37, ditto ditto @ 10 annas each, ...	23	2	0			
5. Drills, wheat, 14, ditto ditto @ 12 annas each, ...	10	8	0			
6. Carpenter, village, 4 days employed adjusting implements, ...	1	0	0			
7. Amount taken as a proportion for wheat culture, from the total annual charges for feeding and keeping farm bullocks,	166	10	11			
8. Amount rent, taken as a proportion from the land tax on the whole farm of $231\frac{3}{4}$ beegas, on 46 beegas under wheat, ...	204	7	9			
9. Amount proportion of interest on farm stock and expenses, @ 12 per cent. on the monthly expenses, ...	24	11	1			
				532	10	3
Carried over Co's. Rs....				532	10	3

Dr. Statement showing the amount of Expenses and Receipts on account of Wheat Cultivation at the Farm of Karode, in the [illegible] 1843-44,—(*Continued.*) Cr.

Dr.	Rs.	As.	P.	Cr.	Rs.	As.	P.	Rs.	As.	P.
Brought forward Co's. Rs.	899		10	Brought forward, Co's. Rs.				532	10	3
				No. II.—*Particulars of charges incurred on account of Packing and Shipping 233 bags of Wheat from Broach to Bombay.*						
				10. Hire of 6 carts to convey wheat to Broach,	1	8	0			
				11. Sifting wheat, charge by "Golas," ..	1	1	0			
				12. Gunny cloth 466 pieces for bags, @ Rs. 10 per 100, ...	46	9	7			
				13. Bags sewing, &c. and twine, ...	5	14	3			
				14. Duty Export at Broach, Custom House, @ $1\frac{1}{4}$ annas per Indian maund, 174 maund 9 seers, ...	13	9	9			
				15. Freight to Bombay, @ Rs. $1\frac{3}{4}$ per candy, 17 candies, ...	29	12	9			
								98	6	7
				No. III.—*Particulars of expenses in Bombay by the Chamber of Commerce, for Shipping to Liverpool, as per letter from the Acting Secretary, dated 17th August,* 1844.						
				16. Petty charges incurred for landing and re-shipping, &c., at Bombay, ...	9	8	0			
				17. Insurance and Policy, ...	44	0	0			
								53	8	0
				18. Freight to Liverpool of 230 bags, weighing 129 cwt. 2 qrs. 12 lbs. @ 63 per ton of 20 cwt., payable in Liverpool, £ 20 8*s.* 3*d.* exchange, suppose at rupees, ...				215	0	0
				Per ship "Ospray," sailed 6th July, 1844.						
Total Co's. Rs.	899	8	10	Total Co's. Rs.				899	8	10

Errors excepted.

Broach:
21st September, 1844.

(Signed) A. Burn, *Superintendent Cotton Experiments.*

To Dr. A. Burn, *Superintendent of Cotton Experiments, Broach.*

Sir,—I have the honor, by direction of the Committee of the Chamber of Commerce, to annex copy of the letter of instructions addressed by the Chamber to Messrs. Arbuthnot, Ewart and Co., of Liverpool, with respect to the disposal of the wheat which you sent to the Chamber, accompanied by the request that they would forward it to England for sale.

The wheat was landed here on the 27th May, and re-shipped on the 29th on board the ship "Ospray," all in good order, with the exception of three bags, which got damaged on the passage to Bombay, two by salt water, and one by cocoanut oil, and they have been destroyed by order of Government, as they were unfit for use.

The 230 bags forwarded were stowed in a favorable part of the ship, and as no rain fell here till sometime afterwards, there is every probability of the wheat being in a sound state on its arrival in England.

Government have been furnished with a note of the expenses of landing and re-shipping the wheat, and of the insurance, and these embrace all the charges incurred here, the particulars of which I subjoin.

The freight is made payable in Liverpool, as usual, and will be paid by the consignees out of the proceeds; the amount of this is also annexed.

It would be gratifying to the Chamber to hear that the out-turn of this shipment proves an inducement to extend the trade in wheat between this country and England.

I have the honor to be, &c.

Bombay, Chamber of Commerce: (Signed) Alex. Sutherland,
17*th August*, 1844. *Acting Secretary, C. C.*

Statement of Shipping Charges, Insurance, and Freight of 230 bags Wheat, shipped per "Ospray," to Liverpool.

1844.	Rs.	A.	P.
May 27th.—Paid cooley hire for carriage of wheat from the pier to the Custom-house warehouse,	2	0	0
,, 29th.—Paid ditto ditto for carriage of wheat to boat for shipment, ...	2	0	0
Carried over Co's. Rs. ..	4	0	0

			Rs.	a.	p.
	Brought forward Co's. Rs.		4	0	0
May 29th.—	Paid boat hire to the Ship "Ospray," ..		4	8	0
,, ,,	Paid peon for watching the wheat for two days, ...		1	0	0
,, ,,	Paid premium of Insurance on £150 at $2\frac{1}{2}$ per cent. £3-15 at exege. of 1-$10\frac{1}{2}$ per Rupees,	40 0 0			
,, ,,	Policy and duplicate, ,,	4 0 0			
			44	0	0
	Expenses of Shipping and Insurance paid in Bombay,..		53	8	0

Freight to Liverpool of 230 bags wheat, weighing cwt. 129-2-12, at 63 per ton of 20 cwt. (payable in Liverpool), £20-8-3.

To Messrs. Arbuthnot, Ewart and Co., *Liverpool.*

Gentlemen,—I have the pleasure to send you enclosed a bill of lading and policy for £150, insured on 230 bags of wheat, shipped on board the Ship "Ospray," and consigned to you by the Chamber of Commerce.

This small quantity has been intrusted by Government to the Chamber for transmission to Liverpool as an experiment, in order to ascertain the practicability of landing wheat from this country in England in a sound state.

Some parcels had been formerly sent, but I understand that by the time they were discharged in England, they were greatly damaged by the weevil, and as an opinion prevails, that if the wheat had been properly cleaned and perfectly dry when shipped, it probably would have arrived in good condition. I shall feel obliged by your stating for the information of the Bombay Government, whether this shipment is found in good order and free from weevil on its arrival.

The proceeds of the wheat you will please remit to the Chamber in a bill on Bombay.

The "Ospray" sailed on the 6th instant.

I have the honor, &c.

Bombay, Chamber of Commerce: (Signed) A. Sutherland,
19*th July*, 1844. *Actg. Secy. C. C.*

Statement showing the Market rate of Wheat at Broach Monthly, from 1835 *to* 1844 *inclusive, being ten years, supplied by the "Nurukia" of Broach.*

Rate per Kulsi, lbs. 656.	1835.		1836.		1837.		1838.		1839.	
	Wholesale.	Retail.	Wholesale.	Retail.	Wholesale.	Retail.	Wholesale.	Retail.	Wholesale.	Retail.
January, ..	22 8 0	23 0 0	19 8 0	20 0 0	14 8 0	15 0 0	15 0 0	15 8 0	20 8 0	21 0 0
February,	22 8 0	23 0 0	23 8 0	24 0 0	14 8 0	15 0 0	15 8 0	16 0 0	21 8 0	22 0 0
March, ..	22 8 0	23 0 0	21 0 0	21 8 0	13 8 0	14 0 0	15 8 0	16 0 0	21 8 0	22 0 0
April, ...	21 0 0	21 8 0	15 8 0	16 0 0	13 8 0	14 0 0	15 0 0	15 8 0	21 8 0	22 0 0
May, ...	21 8 0	22 0 0	15 8 0	16 0 0	13 8 0	14 0 0	15 8 0	16 0 0	24 8 0	25 0 0
June, ...	22 8 0	23 0 0	16 8 0	17 0 0	14 8 0	15 0 0	15 8 0	16 0 0	24 8 0	25 0 0
July, ...	22 8 0	23 0 0	16 8 0	17 0 0	15 8 0	16 0 0	16 8 0	17 0 0	24 8 0	25 0 0
August, ..	23 8 0	24 0 0	16 0 0	16 8 0	16 0 0	16 8 0	19 8 0	20 0 0	24 8 0	25 0 0
September,	22 8 0	23 0 0	16 8 0	17 0 0	15 8 0	16 0 0	19 8 0	20 0 0	26 8 0	27 0 0
October, ..	21 8 0	22 0 0	16 8 0	17 0 0	16 8 0	17 0 0	28 8 0	29 0 0	29 8 0	30 0 0
November,	19 8 0	20 0 0	16 8 0	17 0 0	15 8 0	16 0 0	24 0 0	24 8 0	27 8 0	28 0 0
December,	20 8 0	21 0 0	16 0 0	16 8 0	15 8 0	16 0 0	23 8 0	24 0 0	23 8 0	24 0 0
Total, ..	262 8 0	268 8 0	209 8 0	215 8 0	178 8 0	184 8 0	223 8 0	229 8 0	290 0 0	296 0 0
Annual average rate.	21 14 0	22 6 0	17 7 4	17 15 4	14 14 0	15 6 0	18 7 4	18 15 4	24 2 8	24 10 8

Statement showing the Market rate of Wheat at Broach Monthly, from 1835 *to* 1844,—*(Continued.)*

Rate per Kulsi, lbs. 656.	1840. Wholesale.	1840. Retail.	1841. Wholesale.	1841. Retail.	1842. Wholesale.	1842. Retail.	1843. Wholesale.	1843. Retail.	1844. Wholesale.	1844. Retail.
January,..	19 8 0	20 0 0	17 0 0	17 8 0	15 8 0	16 0 0	10 8 0	11 0 0	8 8 0	9 0 0
February,	23 0 0	23 8 0	16 0 0	16 8 0	14 8 0	15 0 0	11 0 0	11 8 0	9 0 0	9 8 0
March,....	19 0 0	19 8 0	16 0 0	16 8 0	14 8 0	15 0 0	11 0 0	11 8 0	9 0 0	9 8 0
April,....	18 8 0	19 0 0	17 0 0	17 8 0	14 8 0	15 0 0	10 8 0	11 0 0	8 8 0	9 0 0
May, ...	18 8 0	19 0 0	17 0 0	17 8 0	15 8 0	16 0 0	10 0 0	10 8 0	9 8 0	10 0 0
June, ...	18 8 0	19 0 0	18 0 0	18 8 0	15 8 0	16 0 0	10 0 0	10 8 0	9 8 0	10 0 0
July, ...	19 8 0	20 0 0	18 8 0	19 0 0	15 8 0	16 0 0	10 8 0	11 0 0	9 8 0	10 0 0
August, ..	19 8 0	20 0 0	18 8 0	19 0 0	16 0 0	16 8 0	9 8 0	10 0 0	0 0 0	0 0 0
September,	24 0 0	24 8 0	17 0 0	17 8 0	15 8 0	16 0 0	9 0 0	9 8 0	0 0 0	0 0 0
October, ..	19 8 0	20 0 0	18 0 0	18 8 0	14 0 0	14 8 0	9 8 0	10 0 0	0 0 0	0 0 0
November,	16 8 0	17 0 0	16 8 0	17 0 0	13 0 0	13 8 0	9 8 0	10 0 0	0 0 0	0 0 0
December,	19 8 0	20 0 0	15 8 0	16 0 0	11 8 0	12 0 0	9 0 0	9 8 0	0 0 0	0 0 0
Total, ..	235 8 0	241 8 0	205 0 0	211 0 0	175 8 0	181 8 0	120 0 0	126 0 0	63 8 0	67 0 0
Annual average rate.	19 10 0	20 2 0	17 1 4	17 9 4	14 10 0	15 2 0	10 0 0	10 8 0	9 1 1	9 [illegible] 1

Broach:
21*st September*, 1844.

(Signed) A. Burn,
Superintendent Cotton Experiments.

To E. H. Townsend, Esq., *Secretary to Government.*

Sir,—I am directed by the Committee of the Chamber of Commerce to forward to you the enclosed copy of a letter received by them by the overland mail from Messrs. Arbuthnot, Ewart and Co., of Liverpool, and to request that in submitting the same for the perusal and information of the Hon'ble the Governor in Council, you will be good enough to intimate their wish, that steps may be taken to obtain for them from Dr. Burn the necessary certificate of the growth of the wheat referred to in the communication in question, so that they may be enabled to furnish Messrs. A. E. and Co. with this document by the next mail, in compliance with their expressed desire.

I have the honor to be, &c.

Bombay, Chamber of Commerce: (Signed) T. J. A. Scott,
14*th February*, 1845. *Secy. to the Chamber of Commerce.*

To the Secretary of the Chamber of Commerce, Bombay.

Sir,—We have now the pleasure to advise you of the arrival of the *Ospray*, by which vessel we received a consignment of wheat on account of the Bombay Chamber of Commerce. We regret to say, that owing to the *Ospray* having encountered very bad weather, the Captain was under the necessity of throwing overboard part of his cargo, among which were 51 bags of wheat, and of the remainder of the consignment a considerable portion was found damaged by salt water. In conformity with a wish expressed by the Court of Directors for the affairs of India, conveyed in a letter to us from their Secretary, we intend to bring the wheat to public sale, which would have been done before this time, but for the want of a certificate of the wheat being the produce of a British possession, within the limits of the East India Company's charter, without which we are called on to pay the foreign duty. We have in consequence been obliged to put ourselves in communication with the Commissioners of Customs in London, who have at length agreed to allow the wheat to be taken out of bond on payment of the British possession duty, and our giving a bond to produce the certificate of growth in six months, and we must therefore request that by the return mail you will furnish us with such certificate.

Until brought under the notice of the dealers generally at public sale, we should scarce venture to give an opinion as to the suitableness or otherwise of this wheat for the English market, but we may remark, that it is very dirty and full of lumps of clay and small stones, which is very objectionable. By next mail we hope to be able to advise sales, and to hand you a detailed report both on the quality and fitness of the article for this market, and in the mean time,

We remain, &c.

Liverpool: (Signed) ARBUTHNOT, EWART AND CO.
31st December, 1844.

[In accordance with this request, a communication was made to Dr. Burn, by whom the necessary certificates were furnished.]

To A. BURN, ESQ., M.D., *Supt. Cotton Experiments, Broach.*

Revenue. SIR,—With reference to your letter No. 118, dated the 23rd September 1844, I am directed by the Hon'ble the Governor in Council to transmit for your information the accompanying copies of a dispatch from the Hon'ble the Court of Directors, No. 12, dated the 16th July last, and its enclosures, on the subject of the wheat shipped per "Ospray," and to request that you will report whether the objections alluded to in the Report of Messrs. Arbuthnot, Ewart and Co. can be removed, and the quality of the wheat so improved as to render it suitable for bread purposes in England.

2. If this case be effected, it would seem advisable to make another trial.

3. I am at the same time desired to request, that you will bear in mind the instructions contained in the concluding paragraph of the Honorable Court's dispatch, in case any consignments of this article should be made in future.

I have the honor to be, &c.

Bombay Castle: (Signed) E. H. TOWNSEND,
16th September, 1845. *Secretary to Government.*

Our Governor in Council at Bombay.

1. Your letters dated 27th September, No. 41, and 31st October, No. 49, 1844, relate to the shipment per "Ospray" of some wheat raised by Dr. Burn at Broach, and forwarded to Messrs. Arbuthnot, and Ewart at Liverpool.

2. This wheat, 230 bags of which were forwarded by the "Ospray" was, we are informed, grown by Dr. Burn, as an experiment on about sixty begahs of land whereon a crop of cotton previously sown had been destroyed by excessive moisture, caused by the heavy monsoon, of which forty-six begahs were sown with wheat.

3. It appears from the reports of Messrs. Arbuthnot, and the account sales of the wheat which we now transmit, that although of a description well adapted for making flour for sizing, the demand for which is stated to be annually increasing, it is unsuitable for bread purposes.

Letter dated 7th Dec. 1844.
Do. Messrs. Lyon and Fynney, 22d Feb. 1845.
Do. Messrs. Arbuthnot, 14th March. 1845.
Do. do 7th May, 1845.
Do. Messrs. Golden, 29th April, 1845.
Account sale, 20th Feb. 1845.

4. The price obtained for the consignment was five shilling (5*s.*) per bushel for the sound, and three shillings and six pence (3*s.* 6*d.*) for the unsound portion of it, the average price of wheat in the London market at the same period being six shillings and ten pence (6*s.* 10*d.*) per bushel.

5. The result of the first experiment must be considered discouraging, but attaching as we do much importance to the subject, we are disposed to authorize a further trial to be made in Guzerat, provided that Dr. Burn is satisfied that the objections referred to in the above reports can be removed, and the quality so improved as to render the wheat suitable for bread purposes in this country.

6. It will be necessary to pay great attention to the condition in which the wheat is shipped, and to the mode of packing it for stowage on board; that suggested by the Chamber of Commerce of putting it into gunny bags appears to have answered on this occasion, but you will perceive, it is the opinion of the brokers, Messrs. Lyon and Fynney, that this description of wheat is not liable to heat, and would not probably be damaged if shipped in bulk by a quick vessel.

7. A certificate of growth should accompany any future shipments you may make, and it will be necessary to forward at the same time, a statement of the cost, including all charges up to the time of shipment, without which, it will not be possible to form an opinion as to the expediency or otherwise of encouraging the cultivation of this article on an extended scale. We are, &c.

London :
16*th July*, 1845.

(Signed) HENRY WILLOCK,
and other Members of the Hon'ble the Court of Directors.

To James Melvill, Esq., *East India House, London.*

Sir,—With reference to our respects of the 22nd ultimo, we have now to advise you, that the 'Ospray' having on board a consignment of wheat for account of the Bombay Government, has arrived, but we regret to say, that having encountered very bad weather, the Captain was obliged to throw part of it overboard. The remaining portion is not yet all landed, but we expect it will be in time to enable us to bring it to public sale on Tuesday next, which we purpose doing, should we not hear from you to the contrary. We shall take care that you are furnished with a full report on the quality and condition of this wheat: we do not yet return you the documents sent to us, as from the absence of a certificate of growth, it may be necessary to exhibit them at the Custom-house to prove that the wheat is of Indian growth.

Liverpool: We remain, &c.
7th December, 1844. (Signed) Arbuthnot, Ewart and Co.

To James Melvill, Esq., *East India House, London.*

Sir,—We are in receipt of your favor of yesterday's date, requesting to be furnished with information regarding the sale of a shipment of wheat made by the Bombay Chamber of Commerce to our consignments, and with any suggestions we may have to offer on the subject. In our last respects, we mentioned, that the shippers had neglected to send with the wheat a certificate, that it was the growth of a country within the limits of the East India Company's charter, but that we were in hopes, that the Customs authorities would be satisfied on that point on our producing the documents handed to us by you; this, however, we found was not the case, and we were obliged to petition the Board of Customs in London, who, at length agreed to allow us to take the wheat out of bond on payment of the lower rate of duty, and signing a bond to produce within six months a certificate that the wheat was the produce of a district within the limits of the East India Company's charter, or else to pay the full foreign duty, which we did, and then took the first opportunity of bringing the wheat to public sale, when we obtained 5*s.* per bushel for the sound portion and 3*s.* 6*d.* per bushel for the damaged. As we before mentioned, 51 bags of

the wheat were thrown overboard by the Captain of the 'Ospray,' and for these we have yet to recover from the underwriters, which we hope to do in a few days; having sent the documents to London for that purpose; but until this recovery is made, we cannot hand you a closed account of the transaction, but we send you an account sale of the portion of the shipment landed, shewing net proceeds £7 : 3 : 11; when the portion to be paid for by the underwriters has been recovered, we shall close the accounts and send copies to India, but not remit the balance till we receive from thence the certificate of growth of the wheat, so as to enable us to cancel the bond given by us. Enclosed we beg to hand you a copy of the remarks sent us by our brokers, on the quality of the wheat and its suitableness for our market, and we shall only call your attention to the remark—that if free from soil and rubbish, it would fetch 6*d.* per 70lbs. more than the price obtained. This remark alludes to a quantity of small stones and lumps of clay mixed with the wheat, which we have no doubt is occasioned by its being trodden out on the clay floors usually employed in India, and which might be got rid of by thrashing as in this country: under a separate cover we return you the documents received from you, and remain, &c.

Liverpool: (Signed) ARBUTHNOT, EWART AND CO.
14*th March,* 1845.

To MESSRS. ARBUTHNOT, EWART AND CO.

GENTLEMEN,—We have carefully inspected the wheat imported from Bombay in the 'Ospray' and consider some very similar in quality and value to what is grown at Smyrna and Patras, and which cannot be purchased in those countries under (an average 22*s.*) say twenty-two shillings per impl. qr. p. o. b.

The wheat per 'Ospray' will weigh 62lbs. impl. bushel.

The amount for such quality is regular, and to a moderate extent, when better qualities are above an average price, this description would be used for mixing in bread stuffs, but just now the consumption is for making flour for sizing purposes, the demand for which is annually increasing in this country: we do not consider this description of wheat liable to heat on a passage, but recommend care in the shipment to see that it is in good dry condition and free from weevils;

we consider it would be advantageous to ship in bags, but a good quick vessel would most probably not damage in bulk. If the wheat were free from dirt and rubbish, we think it would fetch 6*d.* per 70lbs. more in our market than the sample per 'Ospray.' The expense of screening it in this country would be 3*d.* per 70lbs. but this process does not effectually clean it.

Liverpool: We are, &c.
22nd February, 1845. (Signed) LYON AND FYNNEY.

Account Sale of 230 bags Wheat, Ex 'Ospray,' at Bombay, for account of the Bombay Chamber of Commerce.

PROMPT, 26TH FEBRUARY, 1845.

1845.		£. s. d.	£. s. d.
Feb. 24.—	141 Bags, wg. $121\frac{50}{70}$ bushs. @ 5*s.* per bush., ..	30 8 8	
	34 „ „ $27\frac{27}{70}$ „ „ 3*s.* 6*d.* „ ..	4 15 10	
	1 „ „ $\frac{45}{70}$ „ „ 5*s.* „ ...	0 3 3	35 7 9
	176 Bags.		
	3 „ Torn, emptied into 176 bags.		
	51 „ Thrown overboard.		
	230 Bags.		

CHARGES.

Feb. 1st.—	Freight per bill of Lading, ..	20 8 3		
	Less proportion on 51 bags thrown overboard, ...	4 10 6	15 17 9	
	25 Days' interest on ditto, ..	0 1 1		
	Bank Commission @ ¼ per cent.	0 0 9	0 1 10	
	Dock and Town dues, Bond and Entry, ...		0 17 5	
	Duty on 25 qr. 6 b. 31 qt. @ 5*s.* per qr. ...		6 9 5	
	Cartorage, porterage and twine, ...		1 4 11	
	Laying back for examination, ...		0 8 7	
	Porterage, sampling, &c., ...		0 4 6	
	Advertising for auction Catalogues, &c. ...		1 2 6	
	Auctioneer's commission @ 1 per cent. ...		0 7 0	
	Brokerage @ 1½ per cent.		0 10 6	
	Commission @ 2½ per cent....		0 17 6	28 1 11
	Net Proceeds Cash, 26th February 1845, ...			£ 7 5 10

Liverpool: E. E.
28th February, 1845. (Signed) ARBUTHNOT, EWART AND CO.

To JAMES MELVILL, ESQ., *East India House, London.*

SIR,—Enclosed we beg to hand a copy of a report on the quality of the flour produced from the wheat received from Bombay per 'Ospray', for account of the Bombay Government, to enable us to procure which, we purchased a bag and had it ground. Copy of this report, as well as of that on the wheat itself, handed you on the 14th March, has been sent to Bombay. Referring to our letter of the 14th March, we beg to inform you, that we have received from Bombay the requisite certificate of the growth of the wheat per 'Ospray', but that we are still unable to render a closed account of the transaction owing to our not having yet recovered for the portion of the wheat thrown overboard.

Liverpool : We remain, &c.
7th May, 1845. (Signed) ARBUTHNOT, EWART AND CO.

To MESSRS. ARBUTHNOT, EWART AND CO.

GENTLEMEN,—We beg to inform you, that we have had a bag of Bombay wheat received from you, ground, and find it unsuitable for bread purposes, being very dirty and of an unpleasant flavor, but it is well adapted for sizing purposes, as it possesses considerable strength, and would always find a sale for that purpose in this market. The present value of the wheat is 4*s.* 9*d.* @ 5*s.* per 70lbs.

London : We remain, &c.
29th April, 1845. (Signed) T. AND H. GOLDING.

To E. L. JENKINS, ESQ., 1*st, Assistant Collector in charge, Broach.*

SIR,—By a letter from the Secretary to Government, Territorial Department, dated 17th September, 1845, copy of which was sent you, I am directed to correspond through your office with Government.

2. I am now replying to letter No. 4513, of 16th September 1845, from Mr. Townsend to my address, on the subject of the wheat shipped 6th July 1844, on board the 'Ospray,' to Liverpool. In the 1st para. of that letter, I am requested to report, whether the objections made to the quality of the wheat of this place, can be so far removed as to render it fit for bread purposes on arrival in England. The objections refer to a peculiar earthly taste. This flavor, and also the stones and dirt mixed in the wheat, could, I have no doubt,

be obviated entirely by using proper thrashing and winnowing machines. The grain is trodden out by oxen upon clay floors, (as Messrs. Arbuthnot, Ewart and Co. remark in their letter of 14th March, 1844 to the Hon'ble Mr. Melvill,) hence the intermixture of impurities; and in dispatching the wheat under remark I was precluded by circumstances over which I had no control, from having it properly winnowed and cleaned. But as the wheat of Guzerat is in extensive use at Bombay for baking purposes, and as fine bread is there baked (by Mr. Legget) as can be had in England, there need be no doubt entertained at all on this head. When properly attended to here, previous to shipment, it will, I think, reach England quite free from dirt and unpleasant flavor, or injury of any kind whatever.

3. If this can be effected, it seems advisable to the Court of Directors and also the Bombay Government, to make another trial. In this opinion I entirely concur. But I beg to observe, that the state of my health will not admit of my offering to undertake the supervision of cultivation any where near enough to Broach suited for the culture of wheat. I have suffered very much from intermittent fever during several months past, and unless the change of season, or a short change of air trip, restore my health, I feel quite unfit for the exertion. The season when the wheat crop ripens here, is the end of March, and as that is the proper time to secure a cargo for shipment, (if that destructive insect the weevil is to be avoided or excluded from it) I think, should Government approve, that a sufficient quantity could be purchased by any of the intelligent Revenue officers and forwarded to Bombay, and in this way probably all the objects desiderated, could most easily be accomplished. But also I could go myself to Jumboosur, Dhege, or Hansate, all of which places are famous for the quality of the wheat they produce, and superintend the shipment. If Government adopt this plan, I beg to recommend the shipment being made in bulk as suggested in the report of the brokers, Messrs. Lyon and Finney, as it probably would save expense; every bag containing about a bushel, in the late trial, cost a little above three annas each. This is a question, however, which it would be as well to have the further advice of the merchant upon, as it appears entirely one of cost, and having reference to the kind of vessel on which the investment is shipped.

The quantity required should at the same time be settled, and the time for its arrival at Bombay specified. It ought to be shipped and the vessel sail, I submit, as early as possible in April or May.

4. Although some of the results of the first experiment are not so encouraging as might have been expected, I cannot help thinking, that it has shown that wheat may yet be made a valuable article of export from this country. I shall reserve to a future time, my remarks on the pecuniary out-turn, until the Chamber of Commerce favor Government with the proportion to be paid for by the underwriters on the fifty-one bags thrown overboard. It is clear, the wheat was not all so sound as it might have been, had the 'Ospray' met with less unfavorable weather. There is one point, and the most important one of all, and which this experiment was intended to test, that has been overlooked. It was the *weevil* that was expected by every one to prove the greatest obstacle to the transmission of wheat to England. Former cargoes had invariably been ruined by it. This experiment had special reference to this point, and as nothing is said about any injury from its ravages, I think, it may be concluded, that no insects were found in the wheat. It would, however, be well worth while still to direct inquiry to be made on this point; any cargo shipped unless under precautions similar to what I adopted in this instance in reference to this insect, would, I think, be sure to suffer more or less. The facts of the wheat weighing sixty-two pounds to the bushel, and of the sound portion selling for five shillings per bushel, only 1*s.* 10*d.* less than the average price of wheat in the London market, are very interesting and encouraging: and from this, I think there is good ground to expect that, when the best wheat from this is shipped in a fresh and clean state, it will bring a price equal to the London average rate.

5. The Chamber of Commerce at Bombay have published their opinion that this experiment has turned out very unsuccessfully. But I cannot see any reason to concur in this indiscriminate view of the results. The Chamber had charge of the wheat, and it may be presumptuous in me to differ in such matters from so competent a body of judges, as it is composed of, but I merely look to the facts of the case as shown in the results obtained. The consignment was insured at £150, and if this sum had been realized, it would of itself

afford a very handsome profit—Vide my report to Government, dated 21st April 1844. But this would be a way of proof to me, any thing but satisfactory. From the unfortunate voyage made by the 'Ospray' it may be doubted too whether the whole of the consignment was not in some degree injured thereby a little, as far as the grain was found unfit for bread purposes. But supposing the price, five shillings per bushel (and at which the bulk of the consignment sold) to be the average value of the whole, and taking the actual market rate (Rs. 9 per Kulsi of 656℔s.) of the wheat in Broach at the time when this experiment was tried, vide report referred to above, and allowing the corrected expences attendant on the shipment to stand as charged, I see no obstacle in the way of wheat being made as good a mode of remittance from Bombay to England, particularly were the Colonial five shillings duty removed, as cotton, &c. now are. The grand point to decide was, *can wheat from Bombay be landed at Liverpool in a sound state or not, that is, free from weevil*, and so far as is shown by the reports on the present trial, this question has been satisfactorily answered in the affirmative.

I have the honor to be, &c.

Broach : (Signed) A. BURN,

11*th October*, 1845. *Superintendent Cotton Experiments.*

To T. J. A. SCOTT, ESQ., *Secretary to the Chamber of Commerce.*

SIR,—With reference to my letter (No. 4514), dated 16th September last, I am directed by the Honorable the Governor in Council to transmit for the information of the Chamber, the annexed copy of one from the Superintendent Cotton Experiments at Broach, dated 11th ultimo, to the address of the First Assistant to the Collector at that station, relative to the cultivation and shipment of wheat; and to observe, that if the Chamber, or any member of it, would undertake a small consignment of that grain on their own account, it would, in the opinion of Government, be a far more satisfactory test than any experiment made by officers of Government who are unskilled in mercantile transactions, and whose whole time is occupied with their official duties.

I have the honor to be, &c.

Bombay Castle : (Signed) E. H. TOWNSEND,

21*st November*, 1845. *Secretary to Government.*

To E. H. TOWNSEND, ESQ., *Secretary to Government.*

SIR,—I am directed by the Committee of the Chamber of Commerce to intimate for the information of the Honorable the Governor in Council, that they have this day paid into the general Treasury, on account of Government, the sum of Rupees 157 : 2 : 75, being the equivalent of the proceeds of the consignments of wheat sent home some time ago by the ship 'Ospray,' as per account current, of which copy is forwarded herewith.

The Committee will feel obliged by an intimation of the correctness of the account rendered and payment made.

I have the honor to be, &c.

Bombay, Chamber of Commerce: (Signed) T. J. A. SCOTT,
24th November, 1845. *Secy. to the Chamb. of Commerce.*

The Bombay Chamber of Commerce, to account current with ARBUTHNOT, EWART AND CO., *Cr. for Shipment of Wheat per 'Ospray,' from Bombay.*

Dr.		*Interest, 2nd August,* 1845.	
Aug. 2nd.—To Postages, ...		.. ..	0 7 6
Our draft @ 60 days sight on Messrs. Ewart, Lyon and Co., in favor of the Secretary of the Chamber of Commerce, Bombay Rs. 157 : 2 : 75 @ 1-10¼ Exchange, ...	£14 15 8		
Commission @ 1 per cent.	0 3 0	... ...	14 18 8
Cr.			£15 16 2
1845. March 15th.—By Net Proceeds 176 bags wheat (part 230) per 'Ospray', ...		1845. Feb. 26th 157 0 3	7 5 [illegible]
July 25th.—By amount received from the underwriters for 54 bags wheat thrown overboard from the 'Ospray,'	£7 19 10		
Less Commission @ 2½ per ct.	0 4 0	May 27th 67 0 1 6	7 15 10
Interest, ...		... ...	0 4 6
			£15 6 2

Liverpool: Errors Excepted,
2nd August, 1845. (Signed) ARBUTHNOT, EWART AND CO.

To E. H. Townsend, Esq., *Secretary to Government.*

Sir,—I am directed by the Committee of the Chamber of Commerce to acknowledge the receipt of your letter of the 21st ultimo, forwarding for their inspection copy of a communication from Dr. A. Burn, relative to the culture and shipment of wheat at Broach, for exportation from Bombay to England, and suggesting the expediency of the Chamber or some Member of it, undertaking a small consignment on their own account, with the view of affording a satisfactory test of the adaptation of the article to the home markets.

In reply I am desired to state for the information of the Hon'ble the Governor in Council, that the Chamber is precluded by its rules from engaging in any speculative transaction of the nature proposed, but that there would be no objection to its undertaking the shipment as before, on behalf of Government. They hardly think that, in the present state of matters, any mercantile firm would be disposed to export wheat to England as an experiment, since the risk of failure would be greater than any measure of success likely to be attained would justify it in incurring. The papers, however, are now in course of circulation amongst the members of the Chamber, and should any one of them express a wish to act upon the suggestion contained in your letter, the Committee will communicate with you on the subject without delay.

I have the honor to be, &c.

Bombay, Chamber of Commerce: (Signed) T. J. A. Scott,
24th December, 1845. *Secretary C. C.*

To A. W. Ravenscroft, Esq., *Collector of Broach.*

Sir,—In acknowledging the receipt of your First Assistant's letter, (No. 141) dated 14th October last, with accompaniment relative to the cultivation and shipment of wheat to England, I am directed by the Hon'ble the Governor in Council to transmit for your information, and for communication to Mr. Burn, the accompanying copies of my letter, (No. 5498) dated 21st November last, to the address of the Secretary to the Chamber of Commerce, and of his reply (No. 121), dated 24th ultimo.

2. The Chamber, you will observe, offer no remark on the suggestions contained in paragraph 3rd of Mr. Burn's letter of the 11th

October. If they apprehend the failure of such a speculation when conducted by mercantile men, who have leisure for and practice in such duties, there can, His Honor in Council fears, be little hope of success were it confided to the management of our revenue officers, who, besides other occupations, are generally quite inexperienced in commercial matters.

3. As, however, the Hon'ble Court in their dispatch of the 16th July last, express a wish to have another trial made, you are directed to authorize Mr. Burn to proceed to the districts named in paragraph 3rd of his letter above quoted, and to give him all possible assistance in procuring and shipping such a quantity of wheat as he may propose to send, advising Government and the Collector of Customs at the Presidency, when they may expect to receive it.

I have the honor to be, &c.

Bombay Castle : (Signed) E. H. Townsend,
23rd January, 1846. *Secretary to Government.*

To E. H. Townsend, Esq., *Secretary to Government, Bombay.*

Sir,—With reference to your letter of the 23rd January last, No. 423, I have the honor to transmit for the information of the Hon'ble the Governor in Council, copy of a letter dated 18th instant, No. 20, addressed to me by the Superintendent of the Cotton Experiments, stating his inability to obtain a supply of wheat for transmission to England, owing to the high prices which ruled this season, and to submit, that the reasons given by Dr. Burn for this excessive price are perfectly correct, the failure of the latter rains having occasioned a deficiency in the wheat as well as other crops.

I have the honor to be, &c.

Broach, Collector's Camp, (Signed) A. W. Ravenscroft,
Sookulteerath : 20th March, 1846. *Collector.*

To A. W. Ravenscroft, Esq., *Collector of Broach.*

Sir,—With reference to the orders of Government conveyed to you in Mr. Townsend's letter, No. 423, of 23rd January 1846, on the subject of the trial to send wheat from Bombay to England, I beg to report for the information of the Governor in Council, that, in accordance with the instructions contained in the 3rd paragraph

of his letter, I went to Hansote on the 26th ultimo, and endeavored to arrange for a small quantity, but was forced to relinquish the attempt from the too high price of the grain.

2. The crop of wheat this season is very limited owing to the failure of the latter rains of the season, and in consequence the price is very high.—Rupees 22 per 'kulsi' was asked for wheat at Kutpore, which is the village where the largest amount and best quality of wheat is raised. A 'kulsi' weighs 656lbs. so that a bushel would cost Rs. 2 : 0 : 2, to which shipping expences, freight to England, landing charges, colonial duty and brokerage, would remain to be added. The price now is more than double what it was in 1844, when I sent the wheat that was shipped on the 'Ospray.'

I have the honor to be, &c.

Broach: (Signed) A. Burn,
18th March, 1846. *Superintendent Cotton Experiments.*

To A. W. Ravenscroft, Esq., *Collector of Broach.*

Sir,—With reference to your letter dated the 20th ultimo, No. 84, transmitting copy of one from Dr. Burn, Superintendent Cotton Experiments, reporting his not having purchased wheat owing to the price having risen too high in consequence of the failure of the last rains, I am directed by the Honorable the Governor in Council to request, that you will bear in mind the instructions issued, and report at an early period of the ensuing season, whether you can carry out the wishes of the Hon'ble Court of Directors in this respect or not.

I have the honor to be, &c.

Bombay Castle: (Signed) E. H. Townsend,
14th April, 1846. *Secretary to Government.*

Hand-book for the Cultivation and Manufacture of Tea in Java. By J. J. L. L. JACOBSON, *Knight of the Order of the Netherlands' Lion, and Inspector of the Tea Cultivation in Java.*

[*Translated from the Dutch by* R. W. G. FRITH, ESQ.]

PREFACE.

THE cultivation of tea, when carried on as it should be, is one of the richest branches of agriculture, and it has a very favorable influence on industry, and offers to commerce incalculably great advantages both mediate and immediate.

In China almost all tea planters and tea dealers are rich and influential people, and the celebrity of Canton as a commercial city, and the inestimable riches which pour into her provinces, already now for more than 200 years, are alone to be attributed to that product. The same can be of equal consequence to Java and the Netherlands. Such was the conviction on my mind when I beheld the first tea plants which had arrived in Java.

In the month of July 1827, 500 tea plants were brought from Japan to Buitenzorg, and there planted in the Government garden. My arrival here from Holland took place on 2nd September 1827. The commission with which I was invested by the Dutch Trading Company, carried me to Canton; before my departure I had the honor of an invitation from His Excellency the Commissary General, Viscount Du Bus de Gisignies, to collect in China all information regarding the culture and manufacture of tea.

Three circumstances worked favorably, so as to prevent my investigation concerning that, being brought to a fruitless end; the first, was the instructions in the tea line, which, since the year 1814, I had obtained from my father himself, one of the best judges of tea;—his benevolence and father-like patience were inexhaustible;—a mass of rules for ascertaining the good or bad qualities of tea, and which he must have brought together with the most persevering assiduity, proved to me of the utmost importance, when I subsequently turned my thoughts more seriously to the tea plant: these lessons which I obtained from that worthy parent, I may most assuredly lay down as the foundation of that sound knowledge that I hereafter

gained regarding the cultivation and manufacture of tea. The next circumstance, was the connection, into which I was led from my calling, with the first and most respectable Chinese tea merchants in Canton. Nominated as an experienced tea taster to the Dutch Trading Company, I had, by the necessary orders then issued, (instructions dated 28th April 1827 No.) "that without my interference or knowledge, no tea should be bought, nor even the prices of the same fixed;" a degree of confidence imposed upon me by that esteemed body, which gave me the opportunity of gaining the object I had in view. Every word uttered by the hong merchants and other tea dealers, which in any degree tended to give an insight into the qualities of the product, was most eagerly taken advantage of by me; by them I was introduced into most of the tea establishments at Honan, and having once become acquainted with the people, I soon found my way to the manufactories, and, what was more desirable, to the tea plantations of Tingsoca, situated a little distance off. The knowledge I thus gained in China, I endeavored, in process of time, to bring into practice in Java, and what I observed myself still deficient in Java, I again searched up in China. This lasted for a period of six years; and I travelled backwards and forwards from Java to China for this very purpose. Had it not been for the connection in which I was with the Dutch Trading Company, most probably I never should have attained the object I had in view. Lastly, the third circumstance, which came most powerfully to my aid, was the unceasing kind and benevolent support and treatment that I had the honor to experience from His Excellency the Commissary General, Viscount Du Bus de Gisignies; this gave me the opportunity annually of experimenting upon the before mentioned 500 tea plants from Java, from month to month, placing them out in various directions in the Preanger Government gardens, and in this manner making observations upon them every year. I shall always bring to my recollection the name of this nobleman with the highest esteem and the most sincere gratitude: by his assistance I was enabled to bear up against the difficulties and oppositions, wherewith I so immediately had to contend, and already in 1829 to produce both green and black tea,—yes, and even Souchong and Pecoe, (See General History of Agriculture, published in Batavia in 1829.)

By his Excellency's recommendation I experienced the same aid from the Governor General J. Van Den Bosch, who has been allowed the good fortune, like the first, to introduce the cultivation of tea in Java; while I in the meantime was honored with considerable personal attentions from his respected successors. Viscount Du Bus de Gisignies was likewise the cause of the few tea plants which originally existed in Java having been brought to good account. *Thus*, three incidents worked together, which well considered, served to unite themselves in such a manner as to establish the happy result, which the tea cultivation of Java has already brought about, and which will ere long develope itself still more.

In the month of February 1839, I had already brought round a number of genuine Fokeen tea plants from China into Java; they were planted at Tjisroepen, are still alive, and are, in consequence of the abundance of seed they have produced, the origin of hundreds of thousands of the choicest tea plants. Although it was asserted on their arrival, that they and the Japan tea plants were one and the same kind, it subsequently appeared very evident when coming up, that the China plant in every respect deserved the preference. It was speedily ascertained that the search for Chinese in Java, who understood both the culture and manufacture of tea was fruitless; here and there a man was to be found who could pluck, roll, and dry the leaves, but such produce never paid; and it is worthy of remark, that now, no more than then, notwithstanding every encouragement, no Chinese who had come direct from China, were to be found on Java, who knew how to make merchantable tea, or rather tea merchantable, which is a different thing. The only cause probably that can be assigned for it is, that proper and qualified tea makers have seldom or ever from the first betaken themselves out of the country. For these reasons I was instructed by the Government, to endeavor to bring with me seeds, planters, manufacturers, and chest makers from China. It was, indeed, a difficult undertaking, of which it will be acknowledged to have been almost impracticable, particularly by those acquainted with Canton and its thousands of spies. In the meantime, I had the good fortune in two years to transport hundreds of seeds and plants, and eventually in January 1832, all the workmen that were required, and hundreds of thousands of tea plants

to Wanaijassa, (Krawang Residency.) This expedition was repeated (in consequence of a particular circumstance,*) with such fortunate result, that I arrived again in February 1833, with a set of workmen, and with millions of seeds from China, at Bundong (Residency Preanger Government) where they were placed under my immediate control.

I shall not expatiate on the dangers to which I was obliged to expose myself during a period of six years, and more particularly during these two last expeditions, but I shall simply state, that according to two letters which I received one after the other, on the 29th December 1832, from Mr. M. J. Senn van Basel, Dutch Consul at Canton, when on board of the "*Jeannette Phillippine,*" my interpreter and *factotum*, by name Achung, was seized by the mandarins and taken prisoner, and they expected to find me, my Chinamen, and the tea seeds in his boat, and I was advised to set sail immediately; (Achung was subsequently ransomed for a sum of 500 Spanish dollars through the influence of the said Mr. Van Basel.) Notwithstanding the dangers of every kind, the object was gained, and experience has shown, that the greater part of the seeds that were imported, lived, and the workmen, each in his own department, became skilled, and thereby a healthy state of affairs was speedily established.

Nevertheless, for a short time the tea culture underwent the fate of all new undertakings; and so precarious that the most resolute per-

* From th[illegible]g of February 1832, until my return again to China, I was, by being relieved at Buitenzorg, either in the Preanger Regency or at Batavia; I was not therefore present at the insurrection at Krawang, whereof Mr. R. J. L. Bussendrager makes mention in his physical and geographical description of the island of Java, published at Groningen in 1841, page 86; nevertheless, it is evidently from official documents in my possession, an historical error, that that occurrence was caused by tea planters who had come from China. The Chinese of Tjilankap, the place where the disturbance was created, were of the lowest class, and amongst them there were no tea planters. My Chinamen lived at some distance off over the Routjadara mountain, at Wanaijassa, and were, according to the testimony of the universally esteemed member of council and director of the cultures, the late Mr. J. J. Van Sevenhoven, quiet, industrious and respectable people, and whose appearance was much more favorable than any he had ever previously met with.

severance was necessary to bring it to its present state. But now it has reached a period of fair expectations, for under the administration of the present Governor General, and under the direction of the present Superintendent of Agriculture, the beneficial results of tea cultivation will, ere long, show themselves. It is not from mere supposition that I thus speak, but from an inward conviction of the good effects which the united exertions, coupled with the knowledge and skill, with which these statesmen labor, must bring about.

I trust, that the authorization granted to me by the Supreme Government, by resolution dated 30th December 1842, No. 12, to print the Hand-book for the cultivation and manufacture of tea, and which my worthy readers here have presented to them, may contribute something to these results. As early as 1836, the want of means of instruction and guidance was greatly felt, though the scheme was yet so novel, that people might very justly conclude that theoritical accounts never would be understood by any one. Government in consequence supplied me by degrees with native workmen who were relieved, also the sons of Javanese Chiefs, further, with twelve Superintendents, and lastly, a considerable number of Chinese, making a total of upwards of 200* men, that they might be instructed practically in the tea plantations and manufactories; and they all returned with sufficient knowledge, and accompanied with the necessary notes compiled by themselves, and afterwards corrected by myself, of all they had heard and seen. Very shortly, in consequence of this, and as if at the same moment, tea is produced in all the residencies.

This had also a beneficial result at first, but about two years after, people began to think, that it was time more should be done; the

* I believe that taking all these matters into consideration it will appear evident how that I have from the very beginning employed every means in my power, which the circumstances permitted, to spread the knowledge of the culture and manufacture of tea in every direction: it would indeed have been folly to have wished to withhold that science for one's own benefit, and to introduce a branch of agriculture for which hundreds of people are required, who must possess the same knowledge. The publication of this Hand-book then, will probably do more, than what Mr. Prætorius in his "Thoughts upon the improvements necessary upon the times, in the system of cultivation in Java" page 25, calls nothing more than superficial.

necessity for the existence of clear and explanatory works, which might at any time be consulted, was every where apparent. In July 1839, consequently I proposed to effect this, and in February 1841, I became duly authorized; in September following, I delivered this Hand-book in, and now I have the good fortune to present the same to the public.

It contains the results of my researches after the knowledge of the culture and manufacture of tea, which I carried on for six successive years in China,* and which, in Java, I brought into practice uninterruptedly for fifteen years; mostly with the assistance of my Chinamen, and attended always with comparisons and investigations. Experience has thus taught us, that the tea shrub thrives all over Java, and that in general, the husbandry and industry which it promotes, is capable of no great improvement. At the same time it is to be expected, that, on account of the changes of hills and plains, and the difference arising therefrom in the temperature and lands, satisfactory deviations will naturally find place here and there, from the rule before laid down in this Hand-book. A knowledge thereof cannot in the mean time be obtained, without some principle being shown; that principle, that general rule, I here present to my readers, while they can apply the same according to the state of affairs.

* With reference to that, it will be proper to give an instance; I had, namely, many accounts, which were all unanimous in informing me that the tea plant blossomed in the month of October, (§ 89); this appeared to me exceedingly strange. When, however, on my arrival at *Honam*, in the months of July and August, I became better acquainted, (§ 191); people promised in the course of a short time to take me to the tea plantations. This took place in the month of October, and assuredly I found the plants in blossom. On my return again, it occurred to me that I should have been there even earlier, as I visited both tea plantations and tea establishments, and was then at a place called Tniy-sac-a, (§ 220); I went accordingly in November thither, and witnessed the plants positively in full blossom.

In the meanwhile I should be inclined to hold, that such is to be attributed to the warm aspect of the country, as also to the mild and gentle showers, which fell at that time in the months of October and November; but that in the hilly parts, the time of flowering of the plant takes place earlier, provided always, on the other hand, that no other circumstance interfered with its regularity. I never could procure seeds either from Fokuen or from Feitchau earlier than the month of December, because there, they are collected in October, a year after the blossoming of the plant.

I have considered myself somewhat bound to expatiate upon my labors, until such time as I had gained the knowledge, which I hereby communicate to my readers, so that people might be convinced, that no imaginary theories, but the result of prolonged researches were brought forward, and which time, has in a great measure shown, and eventually will exhibit at once in the clear light of day.

As far as the plan of the work is concerned, I trust I may be here allowed to mention, that I have fancied to myself two different classes of readers. In the first place, such, as are experienced in agriculture and the *manufacture* in a general way, only desire, an insight into the culture and manufacture of tea leaf in a few words; for them probably, the summary of which the first volume is composed, and which by the desire subsequently made known to me of the Government, I had especially prepared, might be sufficient. But I also picture to myself, readers, who are novices in the science of agriculture; beginners, who must learn from the very commencement; young men of from eighteen to twenty years of age, just commencing life: experience, has made me acquainted with the errors they are most liable to, and these I have by sundry explanations and evidences, laid down as a rule in the two following volumes, which are more especially designed for them. From that to a prolixity descending into the minutest details, and the repeating and describing of particulars which are there met with, and such as people are gener-

* I must tender my best thanks to a friend for the gratification which he has afforded to me, just about this time (July 1843) by the presentation of an extract treating upon the cultivation of tea in China, from a voyage round the world, in 1835, 1836, and 1837, published by Ruschenberger, an American physician. In some respects, a few remarks require to be made upon this extract, for instance, regarding the prices of tea; as the thail being taken at 62½ cents., while the Sp. M. being reckoned at f. 2.60, brings f. 3.61; also as regards Souchon and Sehin, the information is devoid of truth. Though this may be ascribed to the difficulty of gaining information from the Chinese, (§ 481); but whatever was to be *seen*, has not escaped the observation of the worthy writer, and such agrees in the main view, with the information supplied by myself to the Government, and with the system carried out in Java. This is particularly remarkable in the pruning; the height of the plants; the annual repetition of the picking; and that the teas after having undergone the first process of the manufacturing, are made ready for the market, in other establishments and by other workmen. The like plan exists in that particular establishment, which is in Java.

ally acquainted with :* from thence I shall perhaps have to console myself with the imputation of rather too great a degree of eagerness (otherwise a great fault) in the interest of the undertaking, and the object I have in view.

No one can entertain a stronger feeling than I do, that in this present work of mine, as in all human undertakings, defects exist, and of the difficulty, which, in spite of every means used, and continually repeated, still here and there explanations will be necessary. For the welfare, both of the undertaking and the country itself, I intreat all competent judges, whenever this may be the case, to bring the same to my notice. The division in paragraphs which I have followed will thereby afford great facilities. The esteemed editorship of the Magazine of Netherlands India, which has already contributed so extensively towards the spread of the arts and sciences, will no doubt be pleased to set aside a few of its pages for the like purpose.

* For instance the business of putting up *Galangs, &c.* over 240 Bouws,*(a)* within thirty-five days, with 360 hands, amongst whom scarcely 120 are able bodied ones, (§ 163 to 167), is considered impracticable, although my official statements, regarding the result of such labors, (accompanied by the favorable accounts from the residents and native overseers of the same) were not susceptible of the slightest contradiction ; then it was that people followed the example, and the good results were not far distant ; at another time people were afraid, that as the expression to lay the ground out, is "*lay sawas out*" (§ 69) no native would undertake to do this under one Sp. M. the kotak, and that this mode of working, although it was not accompanied with much trouble, but beyond that would make the cutting out much more expensive than f. 25, the 500 square rods ; (§ 60) there again my official reports bear testimony against this apprehension : thus the plan was tried ; when immediately it was evident, that the work fell light and was speedily executed ; for the division of labor (§ 70) was good, and what is more, the descents or steps were not made deeper than half to one foot ; (§ 73) the result was in consequence that people were well satisfied with paying f. 25. per bouw ; the more, as it did not any longer appear to be a secret, that notwithstanding one Sp. M. was paid for cutting out one *kotak sawa*, still for the bouw of 500 square rods, even when kotaks of two feet descent were made, often came to only f. 17 to f. 18, on that account one kotak is usually seventy-five rods square, to wit, fifteen rods in length, and five in breadth. As people did not hinder the progress through such doubts, it appeared to me that a prolixity was necessary.

(a) Square rods. 1 Square rod = 144 square feet.
500 = 1 bouw. 1 Bouw = 72,000 square feet.

A glossary of the Malay words used in this Hand-book.

Adjir, ...	a land-mark.
Allang-allang, ...	high grass.
Atap, ...	a thatch (of long grass.)
Babat, ...	to dig, (dig grass out.)
Bamboo, ...	bamboo.
Biliek, ...	bamboo mats.
Dessa, ...	a village.
Ajongdang, ...	a covered hand basket.
Gaga, ...	land just dug, refreshed, and where rice would be planted.
Gallang, ...	a fence.
Gandaroesa, ...	a crop of plants.
Glaegoe, ...	a tree from which Javanese or Saaij paper is made.
Hipoek, ...	seedling plants.
Kotak, ...	a square platform, with raised sides and a step; and whose height is equal with the slope of the ground.
Krandjang, ...	a basket.
Kwalie, ...	an iron pan.
Mandoor, ...	a native overseer.
Pager, ...	a hedge, a wooden partition.
Parang, ...	a weeding instrument, a hoe.
Patjol, ...	preparation for digging.
Pettak, ...	as quare marked out with beacons and with fences.
Poijlong, *(Chinese)*, ...	a drying basket.
Sawa, ...	a watered rice field.
Slokkan, ...	a water course.
Tampier, ...	a flat bamboo fan.
Tipar, ...	a watered rico field.
Tjadas (or wadas), ...	a particular kind of stone.

Introduction.

On the Culture of the Tea plant in general.

1. Japan produces little or no good tea. China supplies the whole world with tea. Java enjoys at present that privilege.

2. In 1827, the first tea plants imported were received in Java from Japan, and in the same year the necessary enquiries were being made in China regarding it. In 1829, the first tea plants were imported into Java from China. The Chinese tea was better than that from Japan, a considerable transport of tea seed, plants, likewise manufacturers, and work people were in consequence sent for into Java, and received from thence.

3. The Japan tea plant throws out lateral shoots, and the China plant shoots more vertically; the latter named tea is more easily manufactured than that from Japan.

4. The tea plant does not *degenerate* in Java; nevertheless change of land takes place when the plants are being put out.

5. Yet a change in the plant takes place, by changing the seeds in different lands. A difference in the color of the fruit becomes also perceptible.

6. Black and green tea are made from all tea plants; partly owing to the nature of the soil, but more especially to the mode of manufacturing it. Plants with fine looking light-brown colored branches, and the stalks of the leaves of a dark red color, produce the best black tea.

7. There is one kind possessing all these indications, which indeed in the hands of a good manufacturer produces finer black than green tea; the leaves are smaller, and the young branches or shoots in greater number than is met with in the common plant. There is another somewhat similar but it is not fit for cultivation, though easily distinguished.

8. There are two other kinds with small, hard, faded-like looking leaves, these must be destroyed.

9. The good quality of tea depends in a great measure upon the soil and the atmosphere, but likewise also to a considerable extent upon the manufacturer: the best tea comes from the high and cool districts, but nevertheless, good tea can be made from low and confined warm districts by such as are well skilled in its manufacture.

10. The quality, however, is very often dependent upon the nature of the country and the situation of the ground; a low situated plantation, open from north to south, surrounded by a semi-circular range of hills, also produces good tea.

11. The tea plant thrives throughout the whole of Java, even in the vicinity of the sea-shore, which circumstance is probably to be attributed to the virtuous properties of the soil. The tea plant from gardens along the shore is not so productive as those from higher localities.

12. 13. 14. The tea plant requires but one mode of treatment. The cultivation of tea is profitable to the planter and of the highest importance to commerce.

Chapter I.

Regarding the Atmosphere.

15. Tea thrives best in mild, temperate or cool climates: such are to be found in the hills. At an elevation of from 3,500 to 4,000 feet

above the level of the sea, where the thermometer (Fahr.) before the rising of the sun would be about 58°, and at 2 P. M. at about 74°. The tea plant is very fragrant. From lowerer elevations it is less fragrant.

16. Fine souchong, fine pekoe, and fine green tea, are obtained from cool localities, the sun being in such places less powerful: lower lands on the contrary produce good kinds of Congou, Kempoy or green tea.

17. At an elevation of twenty feet above the level of the sea, and at a distance from it of about five hours' journey, it is worth while planting tea; provided always, that it can be watered. Tea grown, however, in such a situation, is of a light quality.

18. The tea plant enjoys itself to a great degree in misty and dewy climates, it accordingly does best in the hills, but it can also be cultivated to advantage in the lower lands where dew falls.

19. It is even desirable to plant as high as 5,000 feet above the level of the sea; but such as are not able to plant except in the lower land, can do so without much risk.

20. Tea must never be planted in districts which are constantly exposed to incessant drought, caused more by sunshine than heavy winds. Open plains, exposed to strong winds, and where little or no dew falls, and which are constantly sultry, are never good for the tea plant.

21. Tea may with safety be planted only in places which are subject to temporary heavy winds. The tea plant delights in cool and airy places; whirlwinds occurring in tea plantations are certainly destructive, but they seldom cause any serious damage.

Chapter II.

On the Nature of the Soil.

22. The soil must be, in every respect, of a temperate nature and well prepared; the tea plant will then thrive particularly; it is not only necessary that the property of the soil be known, but one should become acquainted with the requisites for tea soil in general.

23. Good soil well qualified, or of a mild nature, has half to three-quarters of a foot marsh land, under which it is brown, stiff, and clayey (hill) soil. It should not be rich, at the same time not poor, though somewhat sandy, but not more so than just to render

the fine clay crumbling; further, it ought to be light and loose when broken up.

24. The soil ought to imbibe moisture but not retain it; it is favorable for the tea plant to get rain often, but not for a continuance—good clay lands hold moisture in some degree before it sinks away; this is greatly beneficial to the tea plant.

25. Very fat rich land, and such as is never worked, and is all marsh land, is not the best for the tea plant; it is to be met with in the high hill country of Java; it is fine ground and soft, for about half to three-quarters of a foot, black and light as garden mould; deeper, dark coffee brown; below two feet, the clear brown and yellowish hill soil appears. The tea then produced is high flavored, but at the same time gross.

26. But in the vicinity of such soils, which are about 3 to 4,000 feet above the level of the sea, lands are to be found which have already been cultivated; or from whose surface the upper earth has been washed away; these are rich but tempered lands, and profitable for tea cultivation.

27. Fine flavored black and green teas are obtained from black soils, because these lie high, and inferior kinds from various soils, these being much lower; the color of the earth scarcely deserves to serve as a rule, in connexion with the situation of the ground and country.

28. Old lava lands are to be recommended; whenever also lava sand is visible, and notwithstanding the ground is already half a foot deep, it is very fine; but there is then in the dry season strict attention necessary, otherwise the roots of the plants become exposed by the sand being blown away.

29. The finest tea is produced on stony, clayey, and such lands as have sand mixed with them. The substances whereof the stones consist must be similar to that of which the earth is composed; the quantity must be moderate, and the size of one foot in diameter; the small stones which are found lying in heaps together in the earth, ought not to be more than about one foot in diameter, otherwise the roots will not be able to spread freely.

30. Lands which are *too* stony are prejudicial to the growth of the tea plant.

31. Stony lands are favorable, as they always contain moisture—on hills where the masses of stone are large, and the fissures filled with good soil, it is advantageous to plant, provided that in such situations, the depth of soil has been ascertained with the aid of a rattan, for each plant, so that the roots may have a free run for at least two to two and a half feet.

32. *Tjadas* (or *Wadas*) lands are never good for tea, not even when the tjadas has become so old as to be broken with the fingers; but whenever this, though existing, may have entirely disappeared, then those lands may be planted with safety.

33. Tea planted in *sawas* which are not boggy but in a damp state, is desirable, particularly as regards the green kinds; the *pittacks,* however, must be somewhat sloping, and surrounded by a ditch; when in want of rain, the planter should allow from time to time the hill water-courses to be turned so as to run over the field; but it should not be allowed to remain more than half to one hour.

34. Some lands are better adapted for green teas while others again are for black; this can be ascertained by making both kinds from one and the same sort, and comparing the two together; this occurs in the height of the season; old tea lands are the best; and these being renovated and used, both black and green teas continue to preserve their nature.

35. The tea planter is thus free in the choice of his lands, but he should resolve determinately to produce from his plantation one-third green, and two-thirds black tea; this is to his own, as well as the general interest of others.

36. For both kinds the choice must fall upon the sweet lands; it is not easy to taste the earth itself; but notwithstanding, in first touching it with the tongue, the taste is easily distinguished. In the meantime the roots of the *allang-allang* (high grass) are more sure distinguishing characters; their taste differs according to the weather and to their age, in such as are of a sweetish nature, sugar cane-like sweetness will always predominate.

37. Before a plantation is laid out, it must be considered at what elevation this is to take place. There can be but more or less 150 days, when the picking goes on; at an elevation of about 5,000 feet

three pickings, somewhat lower four, and very low down five pickings take place, but the tea taken at an elevation of 5,000 feet is, when well prepared, worth more than that taken at an elevation of only 2,400 feet; according to the state then of the production generally, we must go to work with reference to the qualities.

Chapter III.

On the situation of the districts.

38. On selecting the ground for a plantation, attention must be paid to the situation as well as the extent: it ought to be in circumference about one to two *paal*,* ten or twelve gardens, containing one to one and a half million of tea plants ready to be laid out as occasion may require.

39. Very steep lands are good for planting tea on: gentle slopes however are better.

40. Sometimes in gently sloping lands of one to two hundred *bouws*, heavy steeps and declivities are found, caused by ravines; these must likewise be planted as they are easy of supervision, and the tea from slopes is excellent.

41. Land that is favorably situated, although there may be many slopes, ought never to remain uncultivated; it is profitable, provided the ground is moderately well laid out.

42. Where there are many large trees, the ground is frequently too rich; it is better to select ground in the vicinity; if this cannot be, the trees must be cut down and the ground planted; one tree or so may be allowed to remain as shelter for the work people, but on no account to overshadow the tea plants, for they succeed best in the free and open air.

43. Heavy forest lands can be by degrees commenced upon, by making first *gagas*; next into *tipars*, finally into tea gardens. This takes sometime to effect, but the expence is trifling, and the land loses that superfluous richness which is unfavorable for the growth of tea.

44. Stones lying about the surface are allowed to remain for the *gallangs*.

45. Plains of any extent are always more or less hot; they lose earth by rain; such places therefore must be divided into *pittaks* in the same manner as *sawas*.

* This is not a regular Dutch measure, but one in local use.

46. When *sawas* are to be made into tea plantations, the level of the *pittaks* must be gently sloped, that the water may not remain long on them.

47. The situation of each district must be determined upon for the culture of the tea; but it must be especially ascertained, whether the means there exist, whereby the washing away of the surface earth can be guarded against.

48. The principal requisites are, that the land can be divided into *pittaks* the same as *sawas*, and further that *gallangs* may be made of trees, stones, grasses, weeds, sods of earth, &c.

49. In selecting the localities, attention must be paid to the situation or aspect; the planter should survey the country from all sides, as well with reference to the planting out, as the washing away of the earth; also with reference to the direction in which the work may progress, and above all, whether rice, bamboos, wood for charcoal, planks for making boxes, &c. are procurable.

50. He must, at the same time observe, whether the plantation can be made to lie in a direction north and south, whereabout the factories may be placed, and if there is water at hand to carry them on.

51. Immediately after the choice of land has been made, a piece of nursery ground should be laid out, containing about forty or fifty *hipoeks* of about three-quarters to a foot high, planted four feet square, so that afterwards, as the work is to be divided, this may be available as a stand by when the shrubs begin to bud. At the same time the head *mandoor* must be ready to commence business.

Chapter IV.

On the cultivation.

52. An ordinary plantation ought to consist of about one million tea plants, divided into ten principal divisions, called *gardens;* and each garden split into subdivisions, called *parks;* the shrubs should be planted out about four feet square; and thus there should be for each garden, including the paths, twenty-four *bouws*, and for the ten gardens together, being for the whole plantation, a cultivation of 240 *bouws*.

53. A plantation can be finished in five years, and even in ten, but it is better that it should take place in two; therefore 120 bouws should be cultivated in the same time.

54. The cultivating commences by ploughing, so that the ground may be allowed to freshen, and the weeds, together with their roots and seeds, be entirely destroyed.

55. Although the Natives cultivate the lands, the ploughing must take place under an experienced Superintendent.

56. Three ploughings must take place, and between the 3rd ploughing and the time of planting, rain should fall, so that the ground may become somewhat set again, for planting in soft soil is very unprofitable; three months should be allowed to elapse from the 1st to 3rd ploughing, two between the 2nd and 3rd, and one from the 3rd until the plants are put into the ground, making together six months.

57. It is necessary to commence ploughing in the month of May, though somewhat better in April; the earth is at that time still a little moist, easier to break up, and weeds rot quicker: ploughing later, or in the more rainy months, is very injurious; for then the finest particles of earth are apt to be washed away. The ploughing, however, should be so regulated, that the planting can always take place in November.

58. In high rich lands, where within three months the weeds grow up rapidly, both ploughing and planting must all be finished in four months; six months are here taken as a foundation to go upon.

59. It is here understood that a plantation of ten gardens is laid down in two years; that is to say, 120 *bouws* are cultivated. Each ploughing must be finished in one month, that is, four *bouws* each day. It is also supposed that there is *allang-allang*, which must be first *babat*, and in either case the harrow must be afterwards used. Thus there will be required for four *bouws* each day, as follows:—

1st ploughing	125 men, far *allang-allang*, if there is any.
Ditto ditto	80 ploughs, 80 span (pair) of Buffaloes, and 80 drivers.
2nd ditto	60 ploughs, 60 span Buffaloes and 60 drivers.
3rd ditto	40 „ 40 „ „ and 40 „

Ditto ditto further 125 men to harrow and clean the land. This is taken upon a very liberal scale.

60. Each ploughing must be finished off in four weeks; if it is allowed to last longer, much mischief takes place. If thus the means are wanting for 120 *bouws*, then there must be only forty-

eight or seventy-two *bouws*, that is for two or three gardens ploughed up at once.

61. Loose lands require only to be ploughed about ten to twelve inches deep; that which is harder from twelve to fourteen, *allang-allang* lands sometimes still deeper. The earth should not be made fine, but be allowed to remain in small pieces; therefore, when turned up to the depth of ten inches, the plough should go to the depth of five inches the first time, eight inches the second, and the third time to the depth of ten inches.

62. Such as have the opportunity, should give the preference to digging the lands, instead of ploughing them. Sixty-two men can dig one *bouw*, that is eight men to each rod: 248 men are therefore daily required for four *bouws:* the expences are somewhat less, or at most, come equal to that of ploughing.

63. The ground-work of all business, must be task-work, and teaching,—the same thus with ploughing. Every day the four *bouws* which are to be ploughed the following day must be marked out by long bamboos, and whenever the ground is not laid out immediately, this must be done by *adjirs* at once on every *bouw*, on account of the direction the furrows must lie in, the drivers must be able to see daily the direction the ploughs must take; and the direction in which the furrows run must be decided upon by guess-work with as much accuracy as possible.

64. In ploughing or *patjollen*,—whether it be in high land—or plain,—the ground must be always turned up obliquely so that the furrows do not run in a direction up and down.

65. The deeper the ploughing goes, the closer the furrows ought to be; for instance, if ten inches deep, they should be twelve or fourteen inches apart, if twelve inches deep, they should be ten or twelve inches apart.

66. When the whole of the ploughing and *patjollen* is finished, the harrow must be used, and the ground made clean and even by the hand or with the rake; the weather at such time must not be too dry nor too wet; for the earth should be allowed to remain *crumbly*. For this purpose October is the best month.

67. Planting without cultivating, is in the end very injurious; if any proof of it is wanted, let certain holes be made one to two feet broad, and one to one and a quarter feet deep; then the earth which

was uppermost is kept separate from that which was below, and care is taken, that after planting the upper earth is again placed above: still after a lapse of some years, great loss will be experienced from this practice particularly, in well regulated plantations.

(To be Continued.)

Hints for the cultivation of Begonias.

Begonias may be divided into sub-shrubby, herbaceous, and tuberous-rooted species.

Sub-shrubby, or those with permanent fleshy stems, may be propagated by cutting of the stems, or by seeds, which latter are produced freely.

Cuttings will root readily in almost any situation; they should be covered with a beil glass, and attentively watered. Any sandy soil will be suitable for rooting the cuttings in; drainage being particularly attended to. When the cuttings are rooted they require liberal treatment, i. e. they must have plenty of pot-room and copious supplies of water, not a constant remove from one small pot to another, only a little larger, but a remove that will give the roots space to play: they must be perfectly drained, and the soil should have intermixed with it lumps of porous material, such as charcoal or broken bricks. Vegetable soil is what this plant chiefly delights in.

Herbaceous species may be multiplied by division of the plant and by seeds: occasionally new shoots force themselves through the soil, which, if separated from the plant, must be treated with care; should they have small roots attached to them they must be well shaded; if without roots, they must be treated as cuttings. In other respects this species may be treated as the former one.

The *tuberous-rooted* species require precisely the treatment of tuberous and bulbous-rooted plants.

After the flowering season, water should be gradually withheld, in order to allow of time for natural rest.

When fresh planted out, the roots should be placed in rather a dry soil; the same kind may however be used as previously recommended,—water being given only as the plant manifests signs of growth. When necessary, re-pot the plants, taking care that they have plenty of room, and see that good drainage is given.

Of the more hardy kinds little need be said, as they require the same treatment as the shrubby species, with the exception of less care being necessary.

Some of the species produce seed which should be sown as soon as ripe, scattering them thinly over the surface of a light soil, covering them slightly with earth or sand.

Several of the kinds produce small bulbs in the axils of the principal stem leaves, which, upon maturity, must be treated in the same manner as seeds.

As yet nothing has been done towards hybridising the Begonia; but in this country, where so many and such good opportunities offer, I see no reason why those possessed of collections of this beautiful plant should not be successful in raising new varieties, if only the experiment were tried.

I may add, that I am greatly indebted for the few hints given in this note to an interesting paper entitled "The Begonia, its varieties and culture," which has appeared in a late number of an English periodical.*—R. D.

* *The Horticultural Magazine, and the Gardener and Practical Florist* for September, 1846; a work which contains several excellent papers from the pen of Glenny and other practical Horticulturists.

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INDIA.

Observations on the products and resources of Darjeeling.

By R. H. Irvine, M. D.

To James Hume, Esq., *Secretary to the Agricultural and Horticultural Society: Calcutta.*

Dear Sir,—Perhaps the few following observations on the products and resources of Darjeeling may not be unacceptable, I therefore with great deference venture to lay them before you.

The little I have to say not only concerns these beautiful hills covered with the most splendid forest, but also has relation to the vast flat country about Titalya at the foot of the hills, along the margin of the navigable Mahanunda river.

1st. In relation to the Himalaya hills, near Darjeeling, the forests are of a variety, vastness, and extent incalculable, and in any other country but India, so backward as it at present is in art and science, and the energy to carry both into effect, would become a source of illimitable wealth.

To render such forests fully available, an extensive exploration of them would be requisite; and this again would have the great advantage of opening the surface, and allowing a proper examination of the mineralogy. The substratum of the whole of the hills is of a primitive and metalliferous character, being chiefly hypogenic gneiss rock, of more or less perfect stratification, with superimposed alluvial deposits. I am myself convinced that these hills are not wanting in abundant veins of iron and lead ores; and in great probability both native gold and sulphuret of silver will ultimately be found, as throughout the adjacent elevated land of Thibet, gold dust is an abundant production of a similar stratification in the debris of the rivers from the higher elevations; while Ethiop's mineral or black sulphuret of mercury is also an abundant production. The sandy range forms the barrier to each region, and the formation being integrally the same, it is paradoxical to suppose that ores are only confined to the north-eastern aspect; the probability in fact being that the facility and abundance in which precious ores are found in Thibet, solely arises from the very bare face of the country, the surface being almost destitute of wood. Should extensive mines ever be worked here, a great advantage would be found in the remarkable disintegration of the gneiss rock, which could be worked with great ease and at a small expense; and also in the abundant supply of water, wood and charcoal.

In relation to rendering the forests productive, such elevations as that of Darjeeling cannot at present be looked to; as though the inclined road up is excellent for travellers and ponies, it is not broad enough to admit of large timbers being carried down, nor without mechanical appliances could they be conveyed down the declivities; while, even if conveyed, their rough progress must necessarily ruin the road.

For the transport of valuable timbers a great deal may doubtlessly be ultimately done; and when we consider the wonderful way in which the almost inaccessible pine forests

of Mount Pilatre in Switzerland were rendered a source of great profit, we may well say in such matters—*nil est desperandum.*

The ranges of hills here have very steep slopes, and though it may never be worth while, it is nevertheless quite possible to form wooden spouts or shoots as on Mount Pilatre, from any particular ridge to the valley below, and thus on by a series to the rivers or plains.

But it is to the numerous small and large streams penetrating by the vallies far into these hills that a source of carriage for heavy timbers is to be looked for.

Especially the great Runjeet river, that flows at a distance of eight miles from Darjeeling, about 3,000 feet lower down; which, though flowing with impetuosity, is still very deep, and has few projecting rocks, and would easily float down the very heaviest timbers, presenting less obstacles to timber-floats than many of the rapids on the St. Lawrence and other rivers in Canada and New Brunswick. The greatest difficulty would be the obtaining sufficient skilful wood or raftsmen to pole the timbers down. The Runjeet, after a course of a few miles, joins the Teesta, where the latter is deep and rapid, and down which the timbers could be floated with speed and facility by the Purnabubah to the Mahanunda, and thence by the Ganges and Jellingy rivers to Calcutta, or else down the Teesta and Antri to the Ganges, and by the interosculating streams to Dacca, where wood is in great demand and high priced.

Neither the great Runjeet nor the Upper Teesta have as yet been regularly explored, though their banks have been examined. That these rivers possess sufficient water is undoubted. I would myself, if any such project was likely to be entertained, proceed down both rivers. Than to proceed down nothing can be more easy, especially to me as I have had ample experience and skill in boat building and river navigation. For a preliminary examination however, I would

proceed down on a float of inflated bullock skins formed into a raft, such as those on which the sick were sent down from Jellalabad to Attock on the Caubul river; the materials being easily available, and the expense small. Such an examination would at once decide as to whether timbers could be floated down.

Wood exists in inexhaustible quantities, of the most enormous size (30 feet circumference being common), in vast variety and of the greatest strength.

The higher these hills the greater is the amount of constant heavy rains of course, and the soil being a light loam and often sandy, the roots of the trees are long saturated with moisture, hence the timber at high elevations in these hills is not of a more hard concentrated character than that of inferior heights, contrary to common experience, and doubtless dependent upon the too rapid deposit of alburnum.

On the above account, the timber of the higher elevations is liable, as at present cut, to a species of dry rot from the penetration, into the albuminous parts, of an insect, a species of wood weevil; this destruction is however very slow, and only in exposed situations. Under cover, the Darjeeling woods are seldom liable to destruction by insects.

But, independent of excessive moisture while growing, this destruction of the woods of the higher elevations is mainly owing to the indiscriminate way in which woods are cut down, not the slightest attention being paid to the state of the sap, the season of the year, and what, in relation to timber is most essential, the state of the sollunar influence as to the periodical ascent or descent of the sap, and deposition of alburnum. The bark of none of the trees are ringed to kill them some time beforehand; but each tree is indiscriminately cut down, in flower or fruit, at once without any preparation.

From this it is manifest, that the greatest improvement in the timber, under proper direction, must take place.

I myself think that it is rather a remarkable fact, that hitherto in Calcutta and in the country generally, only three species of wood of a really superior kind have been in common use; the Tectona grandis or teak, the Shorea robusta or sal, and the Dalbergia seesoo or seesoom, all no doubt excellent woods; but far from being the only excellent timber trees in India. These doubtless owe much of their character to the facility with which they are worked by the Indian carpenters; while there remain unused here very many splendid woods of a rather stubborn tough character, that would easily yield to European tools, and would be highly valuable in ship building, engine constructing, as well as for ornamental work.

The finest sal timber supplied for the last few years has been from the Morung forests; finer wood could not be procured; but, it is an undoubted fact, that those Morung sal forests are nearly exhausted and soon will become quite so; the same remarks apply more stringently to the seesoom timber from the same forests.

It is quite evident, that in a few years recourse, for even the supply of Calcutta alone, must be had elsewhere.

It is certainly no exaggeration to say that the forests of Darjeeling and adjacent hills, of the growth of centuries, and of the superficies of thousands of square miles, must be by man quite inexhaustible.

At present, and probably for many years to come, it is clear that any large supply of timber from these hills at a moderate rate, can only be by the channel of the Runjeet river to the Teesta.

All along the Runjeet, however, and also all the upper portion of the Teesta, the most prodigious forests are continued.

The variety of timber is immense, embracing some of the most valuable cabinet woods.

Of the most splendid oaks there are at hand eleven of the most excellent kind:

Quercus fenestrata, Quercus lamellata, Quercus depressa, Quercus glomerata, Quercus semiserrata, Quercus muricata, Quercus incana, Quercus lancifolia, Quercus luppacea, Quercus lucida, Quercus turbinata,	All trees upwards of 100 feet high, and often six feet diameter in the bole.

besides several splendid kinds that I believe to be new species entirely.

Of cabinet woods I shall only allude to the—

Swietenia chloroxylon (or satin wood),
Juglans regia, or walnut (finely veined),
Castanea indica (or chestnut).

In these hills, varying so greatly from the lowest to the very highest elevations, I think I have every reason to believe that the most valuable gums, gum-resins, resins, dye-woods, and lichens will ultimately be discovered.

I myself deeply regret that want of means prevents any speculation in these matters on my part; especially that I do not even possess the means to make preliminary experiments.

Could I obtain the permission of Government, I should be rejoiced during my residence here, to undertake experimental employment, and make all requisite enquiries under the auspices of the Agri-Horticultural Society. Merely preliminary experiments would not be very expensive. The return would be rapid for the outlay. Timbers of the finest kinds fitted for the transverse beams or keels of the largest ships are procurable. Supposing the proper measure sent up, the timbers could be cut here to within one inch of the proper

scantling, to allow for subsequent shrinking, and then floated down.

Kyanization of wood in these regions could only be effected for timber to be conveyed by land carriage, as if sent by water the protective effect would of course be deteriorated. Other protective preparations not injured by water conveyance are however easily available here, as creosote, which might be abundantly prepared.

For other common purposes, the very finest seasoned woods, cut to the right form to nearly the proper scantling, being square, would pack closely, and might be conveyed in a dry state to Calcutta in light boats, purposely built on the Teesta.

2nd. It is worthy of consideration, that hitherto the chief trade between Thibet and India has been between Tashoo Shudon in Bootan and Rungpoor: from Lassa chiefly, and has been of no great consequence. The distance of Lassa from Darjeeling is twenty-five days' journey at the most favorable season; and already there is a considerable resort of petty merchants, and their number I understand has been annually upon the increase. This place is in fact by far the nearest British Territory to Thibet, and of easy access from November to May. A profitable trade might be established in the finest musk, gold-dust, cinnabar, copper, and furs for China, in exchange for common dark-colored woollen cloths, small string pearls, indigo, and died cotton thread for weaving.

3rd. The greater portion of the arts in England are dependent upon chemical manufactories called 'Secret work,' for various supplies absolutely essential to the different processes conducted; I need only instance sulphuric acid, nitric and muriatic acids, chloride of lime, soda, chromic salts, ferro-purpiate of potash. Hitherto in India no such work has been established, the climate throughout the plains being very inimical to all chemical processes as far as the manufacturers are concerned. At first the demand for such chemical

compounds would probably be small; but, if once placed on hand and easily procurable at a moderate rate, the advantage of their application must soon become manifest. Materials are abundant, only manufacturers have to be made, and luckily in India, the natives are exceedingly docile. In this climate, under scientific superintendence, a chemical manufactory could no doubt be successfully established for the preparation of acids, soda from common salt, oil colors, and metallic drugs. Soda once obtained in purity and abundance at a cheap rate, glass of good quality might be manufactured, as well as good soap, both great desiderata in India. The only soda now procurable is the impure '*sajee khar*,' coming all the way from Scinde, and is used in making the common glass '*choories*' for women's arms, as well as in dyeing. Soda could also of course be prepared by the decomposition of sulphate of soda, an abundant product in some parts of India. The facility of water communication from Titalya to Calcutta would be also much in favor of the establishment of such a manufactory.

Many other articles now in demand, and that would, if procurable, become in much greater request, might be prepared. The destructive distillation of oak and other woods would yield pyrolignous acid, which purified, would not only be used in Calcutta for preserving meat and pickles for sea voyages, but as '*sufaid sirka*,' would sell largely to the natives. The same process would yield excellent tar; and continued on a finer scale, abundant creosote might be procured to be employed for the protection of wood for shipbuilding and other purposes. The remaining product, charcoal, would be valuable for smelting iron ores; and supposing lead ores once obtained and the metal reduced, then the acetic acid would make excellent white lead; while minium or red lead would also be an object. Such a cheap and humble branch once established would probably lead to further ramifications.

4th. From Darjeeling itself, only valuable articles would at present pay, on account of the carriage down the hills being rather expensive. These remarks have not however sole reference to Darjeeling; and from Titalya especially, there is excellent water and land carriage.

5th. I have now to mention one article that I consider of really great importance, and that is

VALONIA.

This you are aware is a natural production largely employed in tanning the finest kinds of leather, and is at present a very valuable import into England; is in great demand, and would be very much more extensively used if procurable.

The tanners of England will always employ a new material by which a manifest positive advantage is gained, even at a very considerable outlay, looking to the ultimate return. The tanners' object being of course to render their produce rapidly saleable, and in greater request by the consumers of leather.

On the other hand, the consumers of leather are well aware that those skins tanned most gradually are decidedly the best; and they look to what is called the 'bloom' on the leather as the test of this more gradual process; this 'bloom' is a buff-colored deposit; being in fact a compound of ellagic acid with gelatine, and is only deposited after the skins have embibed tannin to saturation, and is therefore justly considered a certain test of the goodness of the leather. So strong is this prejudice that leather of even the most excellent quality, but of a red color, and destitute of this bloom, will not find a sale.

Tanners are therefore always desirous of employing a substance that is certain to deposit this 'bloom' upon the skins.

It is probable, that a proportion of gall-nuts mixed with the oak bark commonly used, would produce the desired effect; but considering the large bulk of materials employed would be far too expensive.

It is on account of the certainty of depositing the above bloom that valonia has become so great a desideratum amongst tanners in England.

Valonia is a Turkish word, being the name for the cup or husk of the acorn of the Quercus œgilops, growing in great abundance on the hill country east of Smyrna. Valonia, botanically speaking, is the calyx of the fruit of that oak, and is formed of a number of imbricated scales elongated; and when the acorn is removed forms a cup of about one and a half inch diameter, including the scales.

I would desire particularly to impress the fact, that the large acorn capsule called valonia, does not possess the excellent tanning property *par excellence ;* but, that the cup or capsules of almost every species of oak abound in the finest tannin and gallic acid ; and that valonia capsules, first used by the Turks, are chiefly valued as an export on account of their size ; their largeness rendering them a very tangible product, easily collected. For instance, the expense of clearing and collecting the small English acorns would never pay ; the cups alone being valuable ; the fruit containing neither tannin nor gallic acid.

About seven thousand five hundred tons of these acorn cups are imported into England yearly from Smyrna and the Morea, and sold to tanners and dyers. The cups are gathered and dried, and then conveyed on mules to Smyrna, where they are stored in warehouses for several months, in heaps of from three to five feet in thickness. During this time the cups undergo an incipient fermentation, and as they dry, the long spreading scales, which at first completely confined the acorn, become contracted, and allow the acorn to fall out of the cup. When dry, the whole is picked over, to separate the damaged black cups, and all the acorns which contain no tannin. The cups on the surface of the stratum always become damaged during the process. Including the scales, the average diameter is less than two inches.

Valonia, when good, is of a bright color, thick and full grown. When exposed to heavy rain it becomes greatly deprived of its tannin and gallic acid. It becomes also black in color.

The price of valonia in the London market is from 10*l.* to 21*l.* per ton.

About two pounds of valonia on the average, are required for the production of one pound of leather. Leather produced by means of valonia is said to be harder and less permeable to water than that made with oak bark, and so heavy as to constitute the cheapest of all tanning materials; besides the absolutely essential quality of speedily affording the deposit of bloom. The tannin of valonia is different from that of nut-galls, as that affords no pyrogallic acid or destructive distillation. A mixture of valonia and oak bark makes very excellent leather.

Another kind of valonia is also met with in the London markets. This is also a variety of acorn cups, and is called 'camata.' The size of the cups is about that of a cherry. The 'camata' bears a higher price, being in much demand by silk dyers, also because it contains more tannin. It is probably the fruit of a smaller species of oak. The acorn remains imbedded in the seeds. This kind sells, acorns and all, at 28*l.* per ton.

I have only further to instance that in Venice the finest leather is tanned from the large cup of the common holm oak, the cup being more than an inch in diameter.

I now beg to call the particular attention of the Society to the fact, that there are four oaks abundant in these forests, all of which yield acorn cups of a quality equal, if not superior, to the finest kinds of valonia; and two kinds in size and substance wholly preferable. Of the specimens now sent, you will be so good as to observe, that they have lain on the ground since last rains, and are hence in as bad a state as they can be. Still they are splendid specimens of valonia.

They are all the products of very large trees.

The finest and most massive and important of the kinds now sent is I believe entirely from a new species of oak, an immense tree, with wood so very hard as to render it neglected as timber by the mountaineers. The cups or calyces are agglomerated together in threes, are massive, fleshy, and marked by concentric ridges that have exactly the feel and appearance of the rings at the base of an antilope's horn. I therefore specify this as the *Quercus corniformis.*

The second kind of valonia sent is the fruit of the *Quercus lamellata.*

The third kind of valonia sent is the fruit of the *Quercus depressa.*

The fourth kind of valonia sent is the fruit of the *Quercus muricata.*

Of the calyces of these acorns forming valonia, I am confident that the first season, by making proper advances, between two and three hundred tons might be collected.

The whole would have to be collected from the trees when fully ripe, and then dried in the shade in sheds erected for the purpose.

The erection of large store-houses for drying and keeping the valonia would be an easy work here, from the abundance of materials, and skill in cane-work of the people.

Another great advantage here, would be that every mountaineer possesses and uses his '*ban*' or knife most dexterously, with which these people would speedily clear the acorn from the cups,—a very great desideratum.

At the end of October the whole could be conveyed on bullocks to Titalya, and thence in boats by water to Calcutta.

6th. I now beg to come to the subject of the preparation on a large scale of

PEARLASH.

If this article would be marketable in England there can be no doubt of the perfect feasibility of preparing it on a very

large scale in this country, and of a most excellent quality. Of the manufacture of this substance I have myself had considerable experience while I resided at Hoshingabad. At that place I erected a small reverberatory furnace, and made a considerable quantity of pearlash of a most superior quality; the ash I employed was that of the stalks of the cotton plant.

The desiderata for this manufacture are in the first place, water-carriage; good casks for packing the material; cheap labor; and an apparatus, (of a very simple kind of iron evaporating pots, to which I would add a reverberatory furnace, for conversion of the potash into pearlash,) of my own construction and invention.

Both at Titalya and at Siligoric, at the base of these hills, all the most favorable circumstances combine in the highest degree; the supply of fuel is besides inexhaustible. Of green plants, the best adapted to yield potash, an immense abundance exists, instancing in the order of their value—Wormwood, Fumitories, Ferns, Indian-corn stalks.

The cultivation of the sunflower to burn, would probably yield the greatest profit, as the seeds would yield an excellent oil in great purity and abundance.

7th. I now beg leave to call the attention of the Society to the subject of the preparation of an excellent starch for importation into England from common rice.

The whole vast tract of country from the mouth of the Mahanunda to the base of the hills is one immense plain, of the most splendid soil, and an extent of uninterrupted cultivation from one end to the other. The soil is of a nature capable of yielding almost any desired product; but, owing to the facility of irrigation from the river floods, and chiefly, I imagine, owing to the indolence of the natives, the only crops that are raised throughout are rice and mustard, and some sugar-cane. The sugar-cane is of a most superior description, and an immense portion of the country is perfectly well adapted to its cultivation.

In consequence of the immense quantity of rice produced, there is always a great surplus over what the cultivators can consume, and even with all the facilities of river navigation a great difficulty is found in exporting this surplus at even the lowest rates.

The conversion of this abundant and very cheap product into an infinitely more valuable and less bulky article, at a most moderate expense, and that would be certain to find a ready sale in England, does seem to me to be an admirable speculation.

Rice, the material required for the manufacture of the starch, is often sold in the husk at Titalya at six maunds, of forty seers each, per rupee. At that place a manufactory could be established at a cheap rate and on a very large scale. There is most excellent water communication. Wood to make casks for packing the starch is cheap and abundant. Fuel is very plentiful. Labor is very cheap.

Starch is used in England, in immense quantities, not only for domestic purposes but in the silk, cotton, and cloth printing manufactures. The amount consumed in great Britain is very great. The starches are those of wheat, rice, potatoe, arrow-root, East Indian arrow-root, sago, capava and tapioca, Indian-corn, salep, Tous les mois. And all these are not sufficient to supply a sufficient amount of a cheap kind for manufacturing purposes, especially since the extensive use in cloth printing of British gum made from starch.

Ultimately it is very probable that the formation of starch prepared from rice might be received and approved of as a superior and nutritious article of diet.

The object I at present point out is however only that of supplying large quantities of pure rice starch to the silk and cotton cloth manufacturers and dyers at home, either to be used plainly or for conversion into British gum for cloth printing.

How profitably rice may be employed for the formation of starch is shewn by the fact that the careful analysis of Sir H. Davy proved that the very best Middlesex wheat contains 75 per cent. of starch; while rice contains 86 per cent. of that substance.

The separation of the starch from the gluten of rice, is best effected by the addition of a weak solution of an alkali; pearl-ash will do very well; by which the gluten is dissolved, and the starch left unacted on. By this process not only may a larger quantity of excellent starch be obtained than by the common fermenting process from the same amount of grain, but the time required for production is materially shortened, and the ley product or gluten may be made available for other purposes.

Before pearlash is used it must be rendered caustic by time. Each gallon of water used requires only 200 grains of caustic potash or soda. If stronger, the alkaline liquid would dissolve the starch as well as the gluten. To every fifty gallons of the alkaline liquid, 100 pounds of rice are added, and allowed to macerate twenty-four hours. The vessels for this digestion may be of wood, stone-ware, tinned-iron, or tinned-copper.

When the rice has digested the proper time, the alkaline solution of gluten is drawn off into a wooden vessel by means of a tinned syphon or a tinned top fitted to the bottom of the vessel. The residuary rice is then washed by the addition of a large quantity of cold water, which is drawn off and the rice set to drain on sieves.

When the rice is completely drained, it is reduced to flour by grinding with rollers or millstones, and after being sifted, is digested a second time in an alkaline ley of the same strength as before, in the proportion of one hundred pounds of flour to one hundred gallons of ley. To this mixture is added any deposit which may have been formed in the water in which the rice was washed. The flour is repeatedly

agitated during twenty-four hours, and then allowed to deposit for about seventy hours. The deposit consists of two layers, the lowest of which is the fibrous matter of the grain with a little starch; the uppermost is pure starch. The supernatant solution contains the whole gluten.

When the starch is completely deposited the liquor is decanted, and the deposit is agitated with a large quantity of cold water. On standing for about one hour the fibrous matter, which is deposited much quicker than the starch, falls to the bottom, leaving the starch suspended in the liquor. The latter is then drawn off, and passed through a fine sieve, and received in a wooden cistern, and allowed to settle, when the fluid is decanted, and the starch dried and drained.

Such is the process for preparing starch of the first quality from rice. Other cheaper methods also exist.

The easy subsequent process of the conversion of the starch into dextrine or British gum, might be an object of great consideration.

In 1833, the quantity of starch, on which duty was levied, was eight million pounds. The duty was and is heavy, the object being to prevent the conversion of articles of food for man into a substance not consumed as food. This objection would be wholly obviated by preparing starch in India where rice is a superabundant product.

The probable gain on making rice starch would appear to be really very great.

Prime cost of rice, six maunds per rupee,
Loss in manufacture, one and a half maunds,
Expense of manufacture per six maunds of rice, one rupee,
Casks, packing, and boating to Calcutta, six rupees.

Produce of good starch from the above; 86 per cent. would yield about 198 seers. Taking this at the low price of 2*l.* per maund in England, exclusive of duty, the amount would be £8 : 19 : 0.

Outlay on six maunds of materials, at two per rupee, would be sixteen shillings.

Thus the outlay would be to the profit as 16 to 19.

The whole expense of buildings and what apparatus would be required, would be by no means great.

8th. I now beg to draw your attention to the '*chiny*' or sugar from Titalya. It is of a granulated kind, and is of a very superior description, and is deliverable at Darjeeling by retail at nine rupees per maund of forty seers. By wholesale at Titalya the price would probably be from six and a half to seven rupees per maund.

From the inspection of this small specimen it will be manifest what a splendid sugar country the whole alluvial soil at the bottom of the hills must be.

In fact there is every desideratum; the finest sugar-canes, splendid soil, abundant fuel, cheap water-carriage, and very cheap labor.

[The various specimens alluded to in the above communication have not yet reached the Society.]

Report of Proceedings from October 1845, *to September* 1846, *of the Government Cotton Planter at Dacca.*

[Communicated by the Government of Bengal.]

To the Honorary Secretary to the Agricultural and Horticultural Society.

Revenue. SIR,—I am directed to forward, for the Society's use, a copy of Mr. Price's reports from October 1845 to September last.

2. The Deputy Governor will be happy to receive the opinion of the Society on the accompanying six samples of cotton, received with Mr. Price's last communication.* I have, &c.

Fort William: CECIL BEADON,
18*th November*, 1846. *Under-Secretary to the Govt. of Bengal.*

* These samples were referred to a Member of the Cotton Committee, who has obligingly given the following opinion on them :—

" *No.* 1. *Phoolbariah, Bourbon* :"—The best stapled sample of the lot, and with some native in it; stained.

To J. Dunbar, Esq., *Commissioner of Dacca Division.*

Sir,—I have the honor to submit to you for the information of His Honor the Deputy Governor of Bengal, the monthly Report of my proceedings for the month of October 1845.

The early part of this month having proved favorable for the young cotton plants that had suffered from the heavy rains of last month, I have pleasure in stating, that they have, in a great measure, recovered and are looking healthy.

The American seed planted in June, is now about three feet high, and bearing cotton lightly, but a great part of the forms and bowls have been beaten out of the plants by the heavy gale of wind we had on the 30th instant; this I am in hopes will be more beneficial than injurious to the plant, as they had been much checked in their growth by commencing to bear before they had got to a proper size.

I have only been able to plant about eight begahs in cotton this month, which is much less than I had intended doing, this being considered the best month in the year for planting cotton seed in this district; but the sickliness of the season among the coolies employed on the farm, and the difficulty of getting ploughs in this neighbourhood (on account of the greater part of the ryots being Hindoos), to assist in the cultivation, prevented our being able to plant the quantity I had intended.

Early in this month I proceeded to Dacca to make arrangements for the ryottee cotton cultivation, and from thence proceeded to the

"*No.* 2. *Rungpore, Mexican seed:*"—Stained, leafy, nibby; short stapled for its class.

"*No.* 3. *Government farm, American seed:*"—Short stapled for this class, and seems to have been frayed a good deal in the process of cleaning; dull in color, free from seed.

"*No.* 4. *Dacca:*"—Short stapled, slightly stained, free from seed.

"*No.* 5. *Tipperah:*"—Good color and clean, but short stapled, woody, dry and tender.

"*No.* 6. *Assam:*"—Very short in staple and tender; free from seed and clean.

Samples 4 to 6 and 2 appear as if they had been allowed to remain on the plant in the heat of the sun long after the pod had fully opened, by which the cotton is dried up and injured; and this is a frequent fault with East India cottons. Some of these samples are equal to well churka-cleaned Baroach cottons.

different localities which I thought most advisable to try it in; and I have pleasure in stating that in a great measure, through the kind assistance of Messrs. Wise and Glass, I have been enabled to get nearly as many begahs taken as I could spare seed for. J. Wheler, Esq., Collector, having previously kindly offered to get ten begahs planted at Noacolly and ten at Chittagong, which offer I observe by a letter I have had the honor of receiving from him, that Henry Ricketts, Esq., Commissioner of Chittagong, had kindly offered to put in execution.

November 1845.—The unusual quantity of sickness, that has been experienced in this neighbourhood, particularly among the laborers on the farm for sometime, prevented my being able to do much in the early part of this month; but the health of the district having much improved since the 10th instant, I have been busily engaged in cleaning part of the cotton field, and also in planting all I could get prepared; the first planted part of which is vegetating well, and although the sun during the day is very strong, I am in hopes that the latter planted part of it will also do well, on account of the heavy dews we have in the night time at present.

The early planted cotton seed on the farm, and in fact all planted from the 1st of June up to the 30th of September, is now scarcely growing, although healthy enough in appearance, (this was the same case with the small patch I planted at Foolbarriah, in December 1843, and continued in that state until about March, from which time its growth was very rapid, and in May was in full flower, but the severe gale that took place on the 22nd and 23rd of that month, prevented it from progressing as it otherwise would have done, having suffered much from it; but in September it was quite recovered and in full bearing, since which time it has continued to bear, with the exception of two or three short intervals, of about three weeks at each time.) It appears to me at present, that the cotton on the farm will take the same length of time before bearing, and I am in hopes will bear in the same proportion, if so, it will soon repay the few months longer it takes before bearing in this country than it does in America, and particularly so when we take into consideration, that it is a triennial plant here, not an annual, as in the United States.

December.—Several of the coolies on the farm have been engaged all this month in clearing and moulding the young cotton plants, and others in preparing land for seed, and in planting some. The plant generally continues to look healthy, although the nights and mornings during this month have been very cold, and consequently checked it in its growth very much, indeed so much, that it is now nearly at a stand still, nor do I expect that its growth will be rapid again until the weather becomes warmer, and it has had some rain, this of course we cannot expect for a month or two; but I have much pleasure in being enabled to state, that its appearance is altogether very favorable, and that not particularly of any one month's planting, but generally I have planted more or less in every month from 1st of June up to the present date, (which I have had the honor of before stating in one of my former reports was my intention to do,) and which I still purpose doing up to the month of June, by which time I will have all the land on the farm, suited for cotton, cultivated, of which there are only a few begahs that are not so.

I regret that I am only partially able to report favorably of the ryottee cultivation, there being only three places out of eleven, that I have cotton seed planted that way in this district, that look favorable. The seed vegetated well at some of the other places, but has suffered greatly from a small grey grub that has destroyed a great deal of it, and on the remaining places I found on examination that the seed had been planted so deep that it had not been able to force its way to the surface, and had consequently rotted. I hope by the time we have had rain to be able to supply those places with fresh seed and have the cultivation renewed on them.

I have not yet had the honor of receiving any information from H. Ricketts, Esq., Commissioner of Chittagong, or J. Wheler, Esq., Collector of Dacca, respecting the cotton cultivation at Chittagong and Noacolly, consequently I have it not in my power to state what the prospects are in that district.

This farm has been very much infested for the last three months with leopards and wild hogs; the latter are most destructive to cotton cultivation, and root it up and make use of it as food wherever they find it, being particularly partial to the seed, and from the great

quantity of jungle in this neighbourhood, I find it is impossible without elephants to destroy them. I therefore hope that Government will sanction one or two being sent from Dacca to the farm, and particularly so, as it will not be any additional expense to Government, but in fact the contrary, as there is plenty of feeding for them in this district.

January 1846.—Several of the coolies on the farm were employed up to the 15th instant in preparing land and planting some with cotton seed, and the remaining coolies in finishing, cleaning, and moulding the young cotton plants; the remainder of the month they have been principally engaged in ditching, much of which will be required so as to prepare the low lands on the farm for the wet season.

I did not visit the ryottee cultivation this month, as I did not consider it advisable to replant the lands that had not succeeded in the first planting; and on account of the want of moisture in the land, and the length of time seed takes to vegetate in cold weather, I thought it better to defer doing so until the month of March, when we may hope to have some showers of rain and warmer nights.

February.—Not having considered it advisable to plant any seed in this month on the farm on account of the seed planted in the early part of last month not having vegetated,—partly I think from the age of the seed, (having been a considerable time in our possession,) as also from the want of moisture in the land,—the coolies have been therefore engaged all this month in ditching the low lands on the farm so as to enable them to be cultivated in the rainy season.

I regret to inform you that all the young cotton planted since the 1st of October, has suffered very much from the same caterpillar that I before stated had destroyed a great part of the ryottee cultivation. I hope Government may be able to procure a fresh supply of cotton seed for us as much replanting will be required in May and June.

March.—Early in this month I visited the several places at which we have got ryottee cotton cultivation, and I regret to inform you, that with the exception of about nine begahs, I found it almost

all destroyed by insects; but the parties who have taken advances for the cultivation of it are very anxious to get seed to replant the lands that have suffered, which I hope we will soon be enabled to give them, so as to let them have it planted by the end of May or early in June.

The coolies in the farm have been principally engaged all this month in *kudalling* the cotton lands and in preparing land to receive seed, having had heavy rains, accompanied with very high winds, in the latter part of this month.

April.—The coolies have been in a great measure engaged this month in conveying *cotee* from a neighbouring indigo factory to the farm, and in giving it as manure to the land, which I am in hopes will have a very beneficial effect upon it. The cotton plants are now looking healthy and growing well, also bearing lightly, and from which I am enabled daily to pick a small quantity of rather a good description of cotton, although almost in every bowl there is a small portion of it discolored and injured in staple by a small insect that gets into the bowl when very young, it also destroys the seed very much; but I observed at Foolbarriah and also at Luckypoor, that as the plant gets older the injury done by them decreases. I therefore hope it will be the same with the cotton on the farm.

May.—Up to the 15th instant the coolies continued to be engaged in manuring and moulding the young cotton plants, since which time they have been engaged in preparing land for seed, and in planting some partly with Bourbon and partly with American seed, having procured better than half a maund of indigenous seed: they have also been employed in planting it out on some of the land already planted with exotic seed: this I am doing for the purpose of trying the crossing system, on which subject I had the honor of conversing with you when I last called upon you, and should we be able to successfully introduce this improvement into this district, it appears to me, we have every reason to expect to produce a very superior cotton by crossing the fine Dacca kind with the American, as it naturally would combine more or less the fineness of the former with the superior length of the staple of the latter, and also thereby consequently increase the proportion of wool to that of the seed, which is much

required in the fine native kind, the proportion being much smaller in it than in exotic cotton.

June.—The growth of the plant has been very rapid this month, and particularly so on the red soil. Otherwise there is nothing connected with the *neej* cultivation worth trespassing on your time with; the proceedings on the farm having been much the same as that of last month. Neither has there been any, with respect to the ryottee cotton cultivation, not having yet received any seed to supply the persons who require it. Indeed the expectation of the immediate arrival of some during all the month, is the cause of my not being able to report any further respecting it, than that I have received very favorable information from Tagooreeah, of the cotton plants that were not destroyed by caterpillars or otherwise, and also from Foolbarriah of the lands that have been replanted with seed, taken from cotton grown on the small patch of land, that I have frequently in my reports mentioned having planted immediately after my arrival in this district. Should I not in a few days receive seed, I will proceed to the several places at which it has been tried, and supply them, as far as in my power, with seed taken from cotton grown on the farm, although in the present instance I cannot well spare it.

Agreeably to your wish, as well as that of my own, I have got in preparation several parcels of cotton of different kinds, for the purpose of sending to England to obtain the opinion of the manufacturers of it, and the likelihood of its selling to advantage in the European market.

July.—The coolies for the greater part of this month have continued to be employed in preparing land and planting cotton seed, and the remainder of it in weeding and moulding the young plants. The cotton generally this month does not appear so healthy as it did in last month, a great number of the leaves on the plants having withered as if blighted; this has probably been occasioned by the sudden change from intense rain to that of heat accompanied with very drying winds, (so much so, that on my return from visiting the ryottee cultivation, I found all the cultivated lands as dry and hard as they usually are in November,) but I am in hopes the plants will soon resume their former healthy appearance.

On the 12th instant I proceeded to visit the ryottee cultivation, and I regret to inform you that, at Tagooreeah, which I mentioned in my last report having had favorable accounts of, I found the cultivation partly under water, and the remainder of the soil on which it is planted so saturated with water, that the plants were fast changing from a healthy to a very unhealthy appearance. Part of the lands at Luckypoor and Foolbarriah being high, have not suffered from the inundation, and the cotton continues to look healthy. As soon as the water recedes a little, I will supply the persons that have not worked out all the advances made to them with fresh seed, and select lands, if possible, free from inundation.

The cotton wool which I had the pleasure of mentioning to you my having in preparation to forward to you for exportation, I will not be able to deliver for a short time longer; this delay is occasioned principally by the spur-wheel of the gin breaking when ginning it, so that I will now have to extract the seed either by the small churka or by hand picking, either of which is very tedious.

August.—It was with much regret that I informed you in my last report of all the forward cotton on the farm having assumed a much more unhealthy appearance than it previously had, and from the effects of which a great number of its leaves had withered, but this it would have had sufficient time to have recovered from before the dry season would have commenced, soon after which I hope to have seen it in full bearing; but having been severely attacked in the early part of this month by an innumerable number of small green caterpillars, which has deprived it of more than half its foliage, this hope is therefore now frustrated for a time, and indeed what length of time it may take to recover from the severe check it is now suffering from, I am at present not able to state. This second disappointment by insects is particularly unfortunate, as it will naturally destroy any confidence that the favorable appearance of the exotic cotton on the farm might have excited on the minds of the natives, and more particularly as the caterpillars have, in very few instances that I have observed, injured the native kinds of cotton that I am now trying, having confined their ravages almost entirely to the American kind, of which unfortunately, in the present instance, nearly all the forward cotton consists. This partiality

they show to it, I think arises from the better shelter they procure in the large leaf of that kind of cotton, of which almost on every plant they appear to select four or five of the largest, these they fold up separately in a sugar-loaf shape, in which they shelter themselves until they have devoured all the more tender leaves. It appears to me, therefore, to be the formation of the leaf of the native cotton that has protected it from the ravages in this season of the year, as it affords little or no shelter for them. I observed lately they have commenced destroying the Bourbon plant, but not having much of it, I hope to be able to prevent their injuring it much.

I have forwarded a few of the caterpillars to the Agricultural Society, the Deputy Secretary having kindly offered to endeavour to get a naturalist to examine them, so that by discovering what genus they are, he may possibly be able to suggest some remedy for their ravages.*

Memorandum concerning two specimens of Tibetan Wool. In a letter to the Secretary from B. H. Hodgson, Esq., *dated Darjeeling, December 4th,* 1846: *(With two plates.)*

I have the pleasure to send you by to-day's banghy, two specimens of Tibetan wool, carefully taken off the animals, which, however, were not in full feather, and young besides; still the specimens sent will suffice, I hope, to give the Agricultural Society a just idea of the probable value of these wools. The packet No. 1, contains the wool of the Pélúk; No. 2, that of the Húnia or Hálúk.† The former wool is the finer, and is considered the best of Tibet. It is the same I think as the wool of the "Silingia" sheep of the Nipalese; that is, the animal called in one place Pélúk, is the same as that

* These failed to reach the Society.

† These fleeces have been referred to a competent authority, who reports the "fleece from the "Hálúk," or long-stapled wool, as most suitable for combing, and that its value in England would be about seven pence to eight pence per pound, if as clean and free from *grey* locks as the sample. The fleece of the "Pélúk," although of shorter staple, would answer for combing, and also for manufacturing in the common way for low goods; its value would be near the same as the first named."

elsewhere called Silingia. No. 2, is a coarser but still good wool. It belongs to the breed called Húnia to the westward, Hálúk to the eastward. This latter is the black-faced or polycerate sheep, so well known as a beast of burden to the westward, where the "saheb lôg" constantly witness flocks of them laden with salt, &c., coming from Tibet. But it is so employed everywhere throughout the extent of the Himalaya. The Húnia is a tall, well-formed breed, standing about two and a half feet high. The Pélúk is considerably less, not exceeding two feet. Both have small deer-like ears and tails, suborbital and interdigital pores, a moderately arched chaffron, and horns of moderate thickness, turned spirally to the sides and backward; the Húnia being frequently polycerate, that is, having several horns: I have seen so many as five. Both breeds are usually white, with the face and limbs darkened, especially in the Húnia; and some few are black wholly. The females are commonly hornless. These particulars will enable you to identify the animals despite variety of names, should the value of the wool lead you to make further investigation; which, I may add, I shall be glad to assist to the utmost.

Hand-book for the Cultivation and Manufacture of Tea in Java. By J. J. L. L. JACOBSON, *Knight of the Order of the Netherlands' Lion, and Inspector of the Tea Cultivation in Java.*

[*Translated from the Dutch by* R. W. G. FRITH, ESQ.]

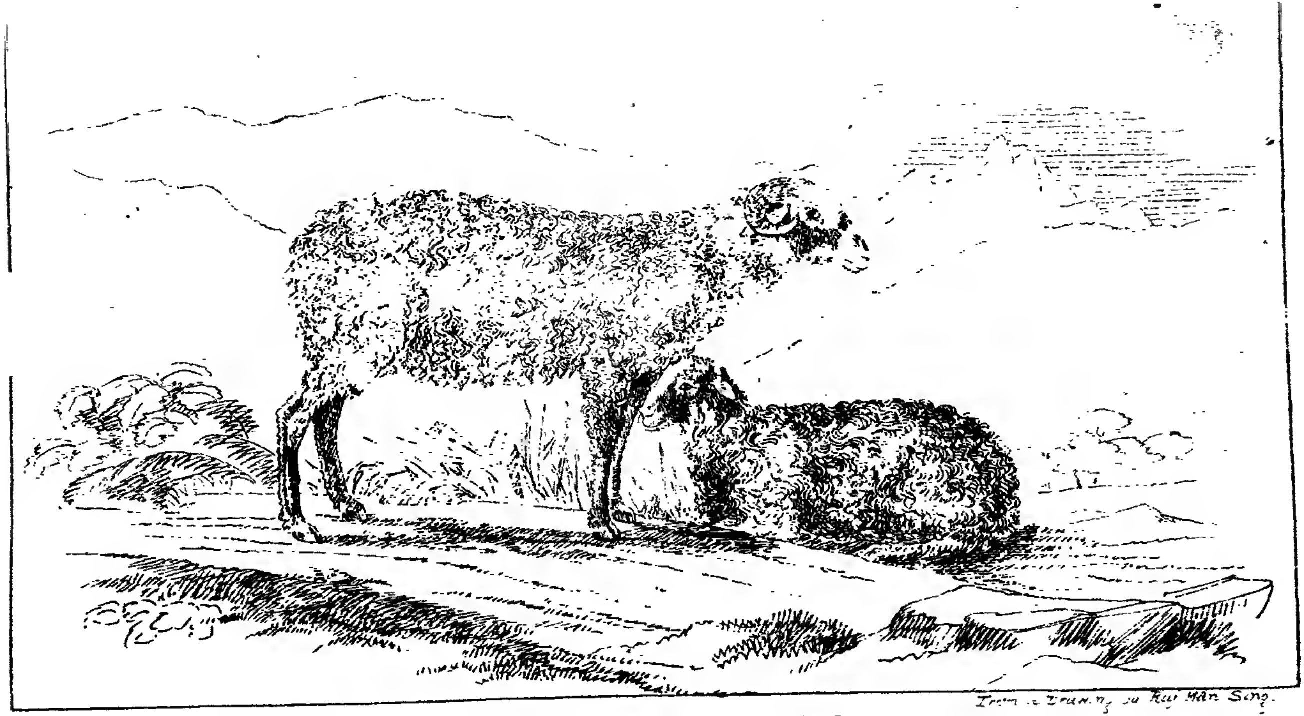
[Continued from page 179.]

CHAPTER V.

On laying out the ground.

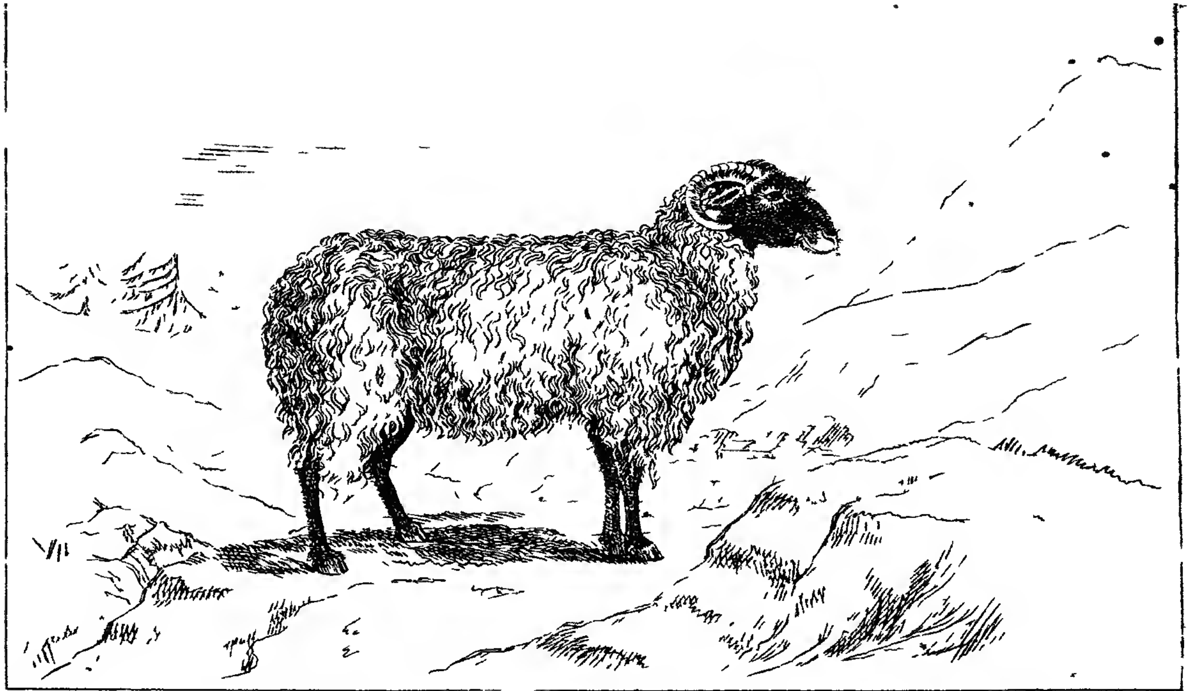
68. Before planting commences, the ground should be laid out, that is, divided into *pittaks,* the same as *sawas* are done.

69. In ordering the men to lay out the *pittaks,* the word "*lay sawas out*" is given, and the work is done with facility and in the proper manner.



From a Drawing by Rai Man Sing.

THE PELÂK SHEEP OF TIBET. YOUNG RAM and EWE



Drawn by Raj Man Sing

THE HALUR or HUNIA SHEEP of TIBET. RAM of 16 Months.

70. It is advantageous laying the ground out at once, after the first time it is ploughed; if the *allang-allang* is any impediment to this being effected, then it takes place at the second ploughing. The trouble about marking the furrows is saved, and the marking out by posts is only necessary as regards the four *bouws*. In either case, the ground must be laid out before the third ploughing commences.

71. When laying them out, the pathways and space for the manufactory must be measured out.

72. All the earth which is taken up while forming the *pittaks*, must be allowed to remain; there should be none taken away.

73. The slope of the *pittak* must be in proportion to its length, as one to forty-two,—thus three and a half rods in length has but one foot slope; *pittaks* of two or three rods are better than those of four or five rods in length; in level lands they are sometimes six to seven rods in length. Narrow *pittaks* with *steps*, in elevations of half to one foot, are preferable to large *pittaks* with deeper steps.

74. Around each *pittak*, fences should be immediately made; when made with clods of earth they require to be half a foot in height; if made of stones, trees, &c., they may be two feet high.

75. Rain is not injurious, particularly when properly carried off by the slope of the *pittaks*. *Slokkans* are therefore unnecessary, except it be to prevent floods: in that case, it is necessary to take notice, in which direction the water has run after the first rain, and following this direction, which the natural slope of the hill has pointed out, the courses for carrying off the water should be cut, although they may take many turns and windings. In this manner no loss, or tearing away of the earth of any importance, takes place.

76. In works of this nature, order and good management are primary desiderata.

Chapter VI.

On the mode of obtaining seed.

77. Immediately after the lands are ready, the planting must commence; the seed should be sent for from other gardens; they ought to have a change of lands, brought from a distance of five or six hours' journey is sufficient. Seeds from rich lands come up very badly in poor lands; any other change is good.

78. Each tea plant produces annually about 250 fruit, which contain about 470 to 480 seeds; many of these are weak, therefore 10 or more seeds, or as many of the fruit must be used as may contain from 14 to 17 seeds, for every plant that is to be planted: 29 to 34 tea plants are to be obtained in this manner from one.

79. Fruit with two or three seeds, and which contain twin or half-seeds, produce also fine plants; but fruits with two or three seeds, containing triplicates and duplicates, are only fit for extracting oil from; these fruits are as large as an apricot, and the color like that of a pomegranate.

80. Tea plants under cultivatiou bear scarcely any seed, except when they are allowed to shoot out. It is advisable to lay out a separate seed-garden for each plantation, equal as one to forty: thus 25,000 shrubs for ten gardens above the one million. The bastard kinds must be carefully exterminated.

81. About the third, fourth, or fifth year, when the trees do not continue to yield much seed, they should be changed for 25,000 of the one million; the old ones are then cut down to below one and a half foot; they produce tea within six or seven weeks; and the 25,000 from which gatherings took place, shoot forth, and these produce seeds within twelve or fifteen months.

82. Seed-gardens require to be manured; if they become impoverished, they are not manured again, but those are which are to serve as a change.

83. The manuring commences with the third year; after another two years, it is repeated; the seed-garden is divided into four parts; every half year, a quarter (thus 6,250 plants) are manured; this takes place in April and in October, the procuring of the manure and the manuring itself takes place, as partially pointed, the same as is practised in the cultivation of the *Nopals*, (for rearing the cochineal insect.)

84. When manure requires to be brought in, pits for manure must be made from cleft river-stone; for 6,250 plants sixteen pits are necessary, each twelve and a half* feet in length, nine feet broad, seven feet deep, and one and a half feet thick, each will hold 788 cubic feet of manure, that is, each division 394, and thus together for

* Rhenish measure.

6,250 plants;—they are left without covering of any kind, or if that be required, they are made of *atap*, four feet in height;—the manure must be allowed to remain in the pits for four months.

85. The cleaving of the river-stones and the mason's work is carried on in a simple though easy manner; the cleaving is done by the aid of fire by whole heaps at a time, and the plastering, with the smooth sides inwards, with wedges and little lime, but over which a covering or plastering of the best cement.

86. Seeds from yearling plants are good, provided they are large and strong; from two year old plants better, and from older ones the best. Seed-plants require to be planted six or seven feet square; they then grow finer and more beautiful. The seed-garden must be kept very clean, and divided into forty smaller ones; at the time of flowering a good look out must be kept to guard against the attacks of insects.

87. It is difficult to distinguish whether the seed is ripe when in the fruit; to ascertain it, the husk should not be opened, and thereby injured;—the usual appearances, a reddish tinge, with a tint of yellow, and the eye deeply drawn in.

88. Ripe tea seeds are of a blackish-brown color, and assume a perfect black-lead color after being unhusked and exposed to the sun for one day.

89. The time of ripening of the seed is very irregular; the blossoming of the plant generally continues from February until May: in China it begins almost everywhere in October or November, and after a lapse of one year, they become ripe. Three families are generally requisite for the gathering and drying.

90. To acquire experience regarding the ripening of the seeds, all planters ought to make observations and notes, according to existing circumstances.

91. Tea seeds in the husk and heaped up, remain good for ten to fourteen days;—to neighbouring districts, they are sent dryed in *krandjangs*, provided they can be planted within ten days. If they are not for dispatch, and cannot be planted for three months, they should then be unhusked and dryed.

92. In drying them, the following care is taken; after the collecting, immediately to be husked, and placed in the sun half an inch

high upon *tampiers,* at a temperature of 81° to 83° Fahrenheit, to remain for one hour—if warmer, a shorter time—if colder, a longer time. When taken out of the sun, they are placed in a barn, side by side, upon platforms; this continues for five or six days, for a shorter time each day, and at last they are left altogether in the barn. In the sun they are turned every quarter of an hour; in the barn five times a day; thus they remain for three or four months.

93. They are transmitted in large square baskets, lined with large leaves, between four layers of earth, three layers of seeds; the upper and lower layer of earth must be three or four inches thick, the intermediate ones two inches; each layer of seeds must contain sixteen pounds, (Amsterdam weight) or more or less 10,000 seeds; this will be a load for two or three men. The *krandjangs* must be covered with leaves. Every evening, or every other evening, each is besprinkled with two or three quarts of water.

94. From the seed which is left every year, an oil is made both for table use as well as medicinal purposes.

Chapter VII.

On Nursery beds, for tea plants.

95. Nursery beds are necessary; A, if the preference is given to planting seedlings; B, if they are required for poor lands; C, if the planter will not use the dried seeds, and the land does not happen to be prepared for the unhusked seed; D, if there is a scarcity of seed.

96. They should lie in the centre of the plantation; may be long, but not broader than from three and a half to four feet, and should be raised one foot above the level of the ground, surrounded by a wall of the same height, the land ought to be light, and even in a certain degree sandy.

97. In the beds small trenches are made one and a half inch deep and three and a half to four inches from each other; in these trenches the seeds are placed next to each other, and lightly covered over with earth about an inch deep; each trench becomes on both sides, an *adjir,* about three-quarters of a foot high.

98. These beds may remain in the open air, but if required to be covered in, either for the heat or rain, simple thatches are made

of the leaves of the cocoanut-tree, upon posts three feet from the ground—the path *ground* itself of the beds is on no account to be covered in.

99. For four or five million seeds, 450 beds are required, each forty feet in length. The 450 beds are divided into thirty portions, and fifteen of these are daily taken care of by two men.

100. Nursery beds lying in warm situations should be occasionally watered; this should be done in the evening, and as many assist in doing so as are required; water having been previously supplied by means of aqueducts.

101. *Hipoeks* for planting out should be eleven to twelve months old and from ten to twelve inches in height; when younger they are not fit to be planted out, certainly not such as are only three or four inches high.

102. The *hipoeks* should not be pulled out, but dug out: the fence around each bed is accordingly taken away, exactly fronting the side of the bed, a hole is dug one and a half foot deep and one and a half foot broad, and the earth made nice and smooth, then with a pointed stick the plant is dug out, and it seldom happens, that the injury the roots may receive when dug out in this manner, is ever to any great extent.

103. When digging out the plants, the bastard sorts should be carefully selected and thrown away.

104. The *hipoeks* should be dispatched immediately after they are dug out; those to be planted on the plantation itself, may be sent on *tampiers;* the roots being all placed one way, and covered over with some earth; 100 to 200 upon each *tampier;* the planters being in readiness to plant them out instantly.

105. When required to be sent a distance of one or two days' journey, it must be done by packing them in square baskets of the following dimensions (inside):

1	foot	6	inches high.
1	,,	4	,, broad.
2	feet	3	,, long.

These are placed upon their sides, and a layer of earth about three inches deep is spread on it, then five layers of *hipoeks;* between each layer of plants two inches of earth; and on the fifth or last layer

(which is against the other side of the basket,) three inches of earth. Thus from 600 to 800 plants are carried in each basket. The basket is then set straight, a shake or two given to it from side to side, the plants watered, then covered in lightly with some long grass;—every evening each basket is well watered; the earth should be somewhat moist: at night the baskets are left open, and closed up again during the day.

Chapter VIII.

On planting out.

106. Planting can be done by transplanting seedlings, by dry or fresh seeds, and also with seed in the pod, either fresh, or eight or ten days old. In China the preference is given to the latter mode.

107. Many advantages attend the plan of sowing with the seed in the pod; as for instance, the trouble of making nursery beds is avoided; the time and expences of planting is spared, protection can be afforded against their shooting up too high; and finer plants can be mere readily obtained.

108. In hot situations however, seedlings ought to be planted out, on account of their being able from their size better to stand the excessive heat of the months of March and April, when the rains have ceased.

109. Planting can be done by offshoots and layers, *tjankoks,* likewise with cuttings, but so long as a sufficient quantity of seeds are to be had, it is better to use them; in the opposite case, the same mode of treatment is adopted with *tjankoks* as with other trees or shrubs; and with cuttings or slips the following; take seven or nine fresh slips, cut with about five or six inches of fine old wood to them, make holes six inches in diameter, and nine inches deep, place the nine cuttings in three inches square with each other: the leaves must not be plucked off.

110. For each tea plant are required:

Five *hipoeks* plants.

Or ten fresh or dried seeds.

Or eight or nine fruits, in which there are fourteen or seventeen seeds (in the husk).

The ripeness of the seeds must be ascertained by experience.

111. Planting with one single seed or *hipoek* does not produce a profitable plantation; they become plants that shoot out, but they do not become the genuine tea plants; they shoot out vigorously every year, and can with difficulty be kept down to a height of about two and a half or three feet.

112. Planting with ten seeds, eight or nine of the fruit, or five *hipoeks*, causes a very vigorous growth; the plants become fine, not high, and like a clump of brushwood; full of fine, young, brown wood, with an abundance of tender leaves; the ground also round about is easier kept in order.

113. The tea plants should be planted about four feet square, without shade; in width they attain a diameter of at least three feet; planting closer than this, is in the end highly disadvantageous, not only for the quantity as well as quality, but for the plants themselves.

114. On heavy slopes and acclivities, where small *pittaks* are found, the planting may be somewhat closer, viz., at four and three, or at five and two feet, and so on, and this because neither the roots nor the branches of the trees can become entangled from the steepness of the ground.

115. The planting must be done in regular rows; this facilitates the dividing of the land, and indeed is useful in the general run of the business, and also for its care and supervision; the exact spot for each plant is pointed out by the cross lines where they intersect each other; the natives are acquainted with this mode of planting, nevertheless it should always be carefully superintended.

116. The *hipoeks* must be deeply planted, at least three or four inches of the stem, with the leaves on, must enter the ground; they are instantly earthed in, leaving all round the stem a hollow about a foot in diameter and an inch deep; after the first rain, this is filled up, and the earth heaped up all round.

117. Seeds either in or out of the husk must be sown deep: holes having been made four or five inches deep, the seed is dropt in, and a light covering of earth about an inch deep, is thrown in; when they have grown about three inches high, earth is cast in, and so on gradually as they increase in size, when at last it is entirely filled, and the earth heaped up round the stem.

118. Deep planting must be generally practised everywhere; it presents exposure of the roots, and promotes the healthiness of the plant, at the commencement of the third year.

119. The most favorable time of the year to plant in is November, the plants then throw out roots twice before the hot weather sets in, that is, in January and March. They can then stand the heat better, and bear up against any unfavorable weather; whereas the contrary is the case when the planting is later.

120. In the beginning of November every garden ought to be ready planted within ten days, to the extent of 100,000 shrubs, that is, 10,000 each day. A sufficient number of sticks for marking the places must be fixed in the ground, by these the men must be guided; two sets of sticks of 10,000 each, are necessary in order to be able to change them; they should be counted over every evening.

121. To plant each day 10,000 plants from the nursery beds, 164 men are required, so for ten gardens each day, 1,640 men.

122. To plant by sowing the seed, scarcely twenty-five are required, so for ten gardens 250 men are sufficient.

123. Every day before the planting commences, the work must be regulated and properly apportioned, and two days before that, trenches should be dug round the trees.

124. Ten *hipoeks* should be planted in holes, one and a half foot deep and one foot in diameter, in every other respect the same as coffee, at the same time with care, so that the work is divided into five parts, and again equally divided amongst the 164 men; every plant as it is planted must be well watered.

125. In such cases watering by day● not in any way injurious to the plant, for the earth, which was dry out of the holes, and which is again used for filling up, has become thoroughly cooled.

126. The plan of planting by seed is divided into seven divisions, amongst the twenty-five men; when the sowers are active, only twenty-one need be employed, for such men not only carry the seed themselves, but do not count them out.

127. If the white-ant prevails, which very often happens in heavy, clayey and poor soils, the holes in which the seeds are to be sown must be filled up with fresh garden, or what is still better, with fresh

and clean clayey earth, such as has never been in any confined situation; the best is from the banks of rivers, or otherwise from recently dug ground in the vicinity of the garden; the first one and a half foot of earth is not made use of; simply placing the seeds for one night in *Katjang** oil, and sowing them on the following day as usual, ought to be an effectual remedy against the attacks of white-ants.

128. A fortnight before the planting commences, the tea plants are cut down in the nursery garden, so that it may be subsequently determined into how many divisions the gardens must be divided.

129. At the same period, and adjoining each factory, huts must be erected, each twelve feet square by seven to eight in height, with a small piece of garden ground to each.

Chapter IX.

On subdividing the Plantation.

130. Immediately after the planting has been finished, the members of about twelve families are to be entertained, from amongst whom, one man must be the overseer; each of them should consist of one man, one woman, and two children from ten to twelve years of age. If by chance there should be one man amongst them who is able to do a little rough carpenter's work, so much the more advantageous. Each family should have a separate house to live in.

131. If the trees of the trial gardens are fit to be plucked, it is necessary to ascertain how many days have elapsed since the pruning and gathering; this number of days shows into how many subdivisions each garden should be divided.

132. On a judicious and careful subdividing of the work, depends, in the strictest sense of the word, the success of the undertaking. It should never be divided by the *bouw*. Allowing each *bouw* to be worked by one man is highly injurious.

133. A plantation should be so divided and arranged, that the work is easily supervised, both as regards the planter and the overseer himself. The gardens ought not therefore to be larger than about 1,000,000 plants. Thus a plantation containing one million plants is divided into ten principal gardens, and each garden into 35,

* A certain kind of *bean*.

40, 45, or 50 subdivisions, provided always, that such dividing is according to the trial garden.

134. The subdivisions should not consist of long straggling pieces of ground, but they should be in compact squares, easily looked after; along the edges of the pathway they may be irregular, but it must not interfere with the superintendence thereof.

135. The gardens may be intersected by the pathways, but, there should not be a greater difference in the size of each than to the extent of about thirty to forty trees.

136. The garden containing one million of trees is numbered from one to ten, and the smaller subdivisions of those from one to thirty-five; the numbering should commence at the top, with stakes marked or numbered, as a garden or section is measured off; it is marked off, and a tree selected, upon which the number is fixed; a set of 2,900 stakes is required for each garden as a change, and they should be counted over each time before they are used.

137. Fences are made of the *Gandaroessa,* which is procurable everywhere; it is planted between the rows; it is not necessary to set aside any ground particularly for this purpose, and when keeping the plantation in order, this should be kept cut low.

138. Immediately after they are marked off, *number*-trees are planted in the most conspicuous places, and on these, the numbers of the gardens and smaller subdivisions are fixed; posts for marking numbers upon, are expensive and disadvantageous, subject to decay, and consequently required to be every now and then changed.

139. The best trees to plant, for putting numbers upon, are those that are of quick growth, and scanty foliage, so that not much shadow is thrown. Thus for instance the *saaij* or *gloegoe** tree, from which the Javanese paper is made, is not good, as it requires annually to be lopped; as also the *kappok*† tree, for this harbours insects in very great numbers.

140. When apportioning the work it should be divided into seven parts, and these again divided amongst twelve men, who can get ready five subdivisions each day. Thus within seven days, a whole plantation, containing about a million plants, may be divided. Two of the most active men of the lot must count the stakes.

* Name of a tree. † A cotton tree.

141. The plantation being thus divided, it is finished; its maintenance thus established; and from this time the advantage of a proper apportioning of the labor, will be more and more experienced.

Chapter X.

On the cultivation of the Plantations.

142. Immediately after the plantation is finished, the cultivation of each division must be commenced by the twelve work-people who have been already selected for employment out of the twelve families, under the direction of the superintendent. Each day they must look after one subdivision, commencing with No. 1; and when the whole are done, again go back and take up No. 1; in this manner, it is kept up all the year round, with few exceptions, they abide strictly by this sort of task-work, and are forbid to meddle with any other.

143. If through neglect, the garden has from the very commencement been left in a jungly state, these twelve men must bring timely assistance at the cost of the planter; their wives and children may be allowed to work, being paid for the same.

144. The usual mode of cultivation is, weeding or digging with the *parang* or hoe, to the depth of one to one and a half inch; the *patjol* may be also used, provided it is not allowed to go deeper. The *Gandaroessa* must also be cut and kept about half a foot high.

145. The weeds which are dug out are put in small heaps between the ridges, each at a distance of about seven or eight feet, these heaps ought not to be more than one and a half foot high by one and a half in diameter; two days after these heaps have been laid out, they are burnt; the ashes are not spread over the ground: when the laborers return after thirty-five days, the heaps are placed next to the spot where the others lay before, thus always at a distance of about seven or eight feet: in time the ash becomes spread of itself over the ground.

146. This burning of the weeds, does not in any way injure the tea plants: a plantation may be wilfully burnt down, but in a year it will again spring up: it is better however for the sake of the plantation that the fire should not be too large; therefore the heaps of weeds should be small.

147. The smoke which on these occasions spreads itself over the plants, is an excellent thing for driving away insects.

148. By the spreading of the ash over the ground after burning the weeds, as also by regular cultivation, the land is immensely improved, and the weeds kept under.

149. In China, the one year old plants are watered with lime water to destroy insects.

150. Notwithstanding the deep planting, the roots come shooting out close from the ends; these are suckers, and should be cut off about half a foot from the stem.

151. The shoots which appear close to and round the stem, should be allowed to remain; but under these, sometimes, and in the middle of the plant, water-shoots appear; these are readily distinguishable by their rank and yellow look; and if they are bent down towards the earth, they snap off; they must be all removed.

152. Roots that have become exposed, and are at some distance from the stem, must be cut off; those that are close to it, are first covered over with earth, and then covered in with clods reversed.

153. The plants should not be surrounded with clods of earth, as this tends to increase the chances of the roots becoming exposed.

154. The regular and constant cultivation and weeding, that is, every thirty-five days, cannot be too strongly recommended; the system of doing so every three or four months must be altogether prevented.

155. For such however as deem it otherwise, the usual reasons will allow of the following exceptions; to wit, firstly, not to dig for the first four months, but to commence with the month of April; secondly, in warm localities after the first weeding in April, again to wait for four or five months, and then to commence about August and September, with the regular weeding and cultivating every thirty-five days; thirdly, in rich bearing lands annually from November to March the grass ought to be weeded with the hoe and not dug; fourthly, if necessary, after the lapse of the thirty-five days, to set the men to work at some other employment, for instance, cutting bamboos, after which the cultivation is again resumed; however, the cultivation must never be interrupted during the thirty-five days, and that interruption must not last more than three or four.

156. Every three or four years there must be an intermediate ploughing; it is only to the depth of one and a half, and only two

ways, once up and once down; from the nature of the plough, which is adapted for only one buffaloe, the earthing up takes place at the same time.

157. This intermediate ploughing, with a view to preserve the paths, must take place ridge for ridge one way, and ridge for ridge the other, and must be commenced at the upper end; by way of change the lands may be dug, and this should be in April or October, but better still if done in April, while in each garden or principal division daily one subdivision should be ploughed off. For the remainder three ploughs are sufficient; some of the people hold themselves in readiness to finish the earthing up; and thus the usual twelve people finish off this work.

158. A year after planting, about the month of December, observation must be made, as to whether any bastard tea plants are existing amongst the true kinds, if so, these must be changed forth with either by planting seeds or *hipoeks*.

159. The superintendent who has charge of the cultivation, should be every day, one *subdivision*, in advance of the people; and place, as he finds it a mark at each bastard kind; on the following day it is changed by the workmen; in thirty-five days this is all finished; but if there chance to be many bastard plants, it may be done in twice thirty-five days, viz. each day the half; but then it must, the first time, the half of thirty-five, and the second time the remaining half.

160. The attention of the cultivators must be turned to the following points: firstly, keeping in order the ditches round the *pittaks* every day in the plantations; or, if there is no weeding from November until March, then in six at once, or six each day; secondly, the sides of the *pittaks* or *gallangs* to be kept in order, by merely cutting the grass, and allowing the roots to remain in the ground; thirdly, if the planting, has taken place by seed, the filling in, and earthing up, must be done three times, if by *hipoeks*, once; the usual cultivation is thus delayed for four days; fourthly, after pruning the tree, the cuttings to be laid out in rows.

161. A plantation may fail from the following reasons: first, having planted with single *hipoeks*, and uot having set them deep enough in the grouud; secondly, from having used unhealthy *hipoeks*;

thirdly, from having sown unripe seed; fourthly, from a washing away of the earth, owing to a want of judgment in the selection of the land.

162. In the first three cases the measures that ought to be adopted must be the same as if a new plantation were commenced upon; further, next to the old plant and close to the root a new one must be planted in the seed; this must be done in November; each day three subdivisions must be worked off, being equal to 8,750 plants; the twelve families are sufficient for that purpose; the women and children can also assist, being paid for the same. Seed may be collected from the old plants, or the leaf may still be gathered from it, until the new can yield a crop, when the old are cut down.

163. In order to recover, in the fourth case, there must be no heaping up of earth round the plants, but fences may be raised at every two rows, and sometimes after each one, but no extra material must be brought for that purpose.

164. The plantation itself must be allowed to run to jungle, until it is about five or six inches high; this it will do in two, three, or four months, in proportion as the ground is more or less impoverished; at the same time sods of earth are placed there, and trenches made through. This is done in October and November; against the attacks of insects no precautions are taken just now; during the time the work is at a stand still, the people are elsewhere employed.

165. If trenches for protection must be made, and the perishing plants changed at the same time, then one subdivision in each garden must be worked per day: the work is divided into ten parts, these will require thirty-six persons for each garden, and they will be found from amongst these, already in service.

166. When making the trenches, the places should be marked out the day before, by the aid of *adjirs*, for the following day: they should be in a proper direction to guard against the washing away of the earth. At both ends of the trench, and particularly there, where they take a different turn, there should be an angle running upwards; the direction commences from above. The *adjirs* are placed three or four feet apart from each other: there are two sets of *adjirs*, each of 2,500 pieces, required for changing.

167. The planter must not allow all the work to commence in all the gardens at the same time, but one day in two; within five days they are all in work, and within forty the whole is finished; he is then able to superintendent every thing everywhere with facility.

168. It is not advisable to exercise too strict a superintendence over the people and come upon them suddenly and by surprise, it does not answer in work of this nature.

169. The women and children, in the meantime, must, from the very commencement, make up materials (against payment for the same,) and the men manufacture the tea which has been lopt off.

170. Where tea plantations are spread, that is, lay far from each other, so as not to be properly looked over, there must be a separate plantation made, consisting of such as are near each other, about one or two roods in circumference; each plantation then becomes placed under a separate inspection.

171. In order to administer properly that maintenance and prudence which is requisite for a plantation, the planter, before commencing thereon, must watch the progress of all labors; he will then find, that by a little order and regularity they can all be performed with few hands, and little or no difficulty.

Chapter XI.

Regarding the Ryots and Work-people.

172. By the commencement of the second year there are again thirteen native houses built up, the same as before, and a couple of months later also, thirteen families are taken into service, consisting in numbers the same as before mentioned. From amongst these, one acts as the factory overseer or superintendent; and it is useful to have under him a carpenter. Out of the twenty-four working men, who are now in service, the twelve best are selected for the factory, and the remaining twelve for the plantation.

173. Between the commencement of the second and third year, these twelve families keep themselves busy, together with the women and children, and separate from the first twelve, in making material, in arranging the factory, and particularly so with the lopping; while learning to lop, they pluck and make tea; they become thus in one year, qualified to undertake and commence the gathering.

174. The women and children must be paid separately, and in the day-time, for all the work they perform, in proportion to the fixed wages the men receive.

175. This paying to the women and children, must not take place by an increase of wages being given to the men; they must themselves receive daily some trifle, that they may be enabled to meet their own little wants.

176. The twenty-four families and two superintendents must not be under the same roof; each should have a small house for themselves to live in; the planter must always take care that they all likewise have a small garden attached; and that they are provided at the proper time with buffaloes, and as far as practicable, with *sawas* or *tipars*: this binds the people, in a great measure, to their lands.

177. Amongst the 104 people composed in the twenty-four families and the two superintendents, there should be twenty-six working men; the remainder need not be, strictly speaking, twenty-six women and fifty-two children; and the families also may consist of less than four in number, provided the total number is not less than 104 altogether.

178. The planter may have also work done by the village people; in that case these people must be especially provided with separate houses; they seldom work longer than ten days; when they go away, others coming in their places; they very soon learn the work; and then when the whole of the people are acquainted with it, this changing of people rather turns out to the advantage of the planter.

179. The village laborers do the same work as the fixed establishment, but there are no more of them taken into service than are actually necessary; the superintendent of the garden remains the whole year, the head manufacturer during the harvest, and the principal superintendent always in service.

180. The twelve men employed in the mere cultivation, must be liable to be changed withont further notice being given; in ordinary changes, as for instance, factory work, five days notice must be given to the heads; and regarding new applications eight must be given; there must be fourteen days likewise notice given of the number of people who will be required for the harvest time: further, the

planter should keep a statement thereof, with the names and list of work done according to the forms laid down.

181. The village people must be paid as follows; for factory work and making up material, by the job; for cultivating the gardens, by daily wages: for plucking, so much per pound of fresh leaves. The manufacturers are paid so much per pound of dry tea, which they produce; to procure good material, it should be procured in the plantation itself, and not made up in the villages.

182. The superintendent represents the planter, both in reference to the regular laborer as well as the village people, at such time as he is not present; he must take care also that every man knows what is to be paid to him.

183. All the superintendents and deputy superintendents must render to the planter a daily account of the work which has been done; these reports are made verbally; but the planter keeps a regular and correct register according to existing forms, such of the work as has been omitted, must be attended to the next day. Particular care must be taken to prevent confusion in the daily work.

184. Under ordinary circumstances, as for instance, in building factories, changing the tea plants, putting up *gallangs*, &c., the head-man of the village people must be present every evening before the planter. The work for the following day is then fixed, and this communicated in writing to the head of the village people, who distributes the orders relating thereto amongst the deputy superintendents and others, and the following day all matters progress with regularity.

185. Where the plantation of 100,000 plants is divided into 35, 40, 45, or 50 subdivisions, the number of plants become less, and probably also the extent of the land, according as the subdivisions are more than 35, and so much the less is then daily to cultivate, gather, and manufacture, &c., therefore, there are required for each plantation of 35 subdivisions, twenty-four families, for one of 40, 20 —for one of 45, 18—for one of 50, 16, &c.; further, the number of superintendents does not decrease, and the work is always (upon the basis of the 35 divisions,) regular in keeping.

186. In the gathering time when ten plants produce one pound of leaves, then the number of persons for thirty-five divisions as laid

down, is considered sufficient; say twelve for cultivation, two for fire-wood, two for making chests, two for bringing bamboo-leaves, forty-two for gathering, four for carrying the leaves, twelve for manufacturing, and twenty-six still remaining to be disposed of: whenever also the gathering yields one pound of leaves, the last twenty-six are divided amongst the rest, and eighteen of them to the gatherers; consequently, under proper direction, 104 hands turn out to be sufficient. Further, men, active gatherers, can collect sixteen katties of leaves per day, here, however, only five katties are allowed per each man of the forty-two, and seven for each of the sixty.

187. To extend the cultivation of tea to forty million of pounds, 416,000 hands, £18,020,000,—should it be required that the extension takes place in twenty years, then in the first year are required 20,800 hands, and £906,000, and the same quantity required annually to be added.

188. Eight hundred thousand trees yield seed enough for one-twentieth of this extension; the old trees which droop, and which must be changed, then shoot out; in the second or third year these yield seed enough; and afterwards every plantation procures seeds from its own seed garden.

189. The seed garden, the charcoal, the packing people, and the commission to pensioned work-people, are charges which do not appear in the statement before mentioned, but they will be found in other accounts.

190. The pensioned work-people should get commission upon the tea which they produce; not for quantity but for the quality, that is, upon the price for which the tea is sold.

191. The cultivation of tea in Java is carried on in the same spirit, and the manufacture in every way the same as in China; but the manufacturing, with more order and cleanliness.

(To be continued.)

Correspondence and Selections.

CORRESPONDENCE REGARDING THE QUALITIES OF THE WALNUT WOOD OF DARJEELING. COMMUNICATED BY A. CAMPBELL, ESQ., SUPERINTENDENT OF DARJEELING.

To JAMES HUME, ESQ., *Secretary Agricultural Society.*

DEAR SIR,—In the last No. of the Journal of the Society, part ii, vol. v, page 71 of Correspondence and Selections, there are two notes from Mr. C. Beadon and myself, on the subject of transporting some of the timbers of the Himalaya to the Calcutta market; and on the quality of some specimens of wood forwarded to Mr. Beadon for examination. As the correspondence arose out of some enquiries made Mr. Beadon into the qualities of the walnut wood of this place, with especial reference to its fitness for gunstocks, and as the subject is of some interest, I have the pleasure to forward extracts of notes connected with it for the information of the Society.

It appears from No. 4 of the series, that the specimen gunstock sent by me was not of a promising description. It is very likely that it was made from the timber of a branch and not from that of the trunk It was not selected with any care, but taken at random from wood I had by me for house carpentery work. Sometime after the date of this correspondence, Dr. Irvine, of Patna, who was then at Darjeeling, entered into a contract with the Military Board for the supply of 1,000 Rs. worth of walnut wood gunstocks: but I have not heard the result of this extended experiment.

Yours truly,

Darjeeling: A. CAMPBELL,
October 31*st*, 1846. *Superintendent.*

To A. CAMPBELL, ESQ., *Darjeeling.*

MY DEAR SIR,—I shall be very much obliged by your giving me what information you possess, or may be able to collect, in regard to

the growth of the walnut tree in the vicinity of Darjeeling, and generally throughout Bootan. I wish to ascertain, as far as may be possible, the localities in which the trees grow with reference to facility of transport towards the plains, the size they attain, and the quality of the timber, especially as regards its fitness for gunstocks. It is also desirable to ascertain, the extent to which the timber may be procured, and the cost at which it could be conveyed to Calcutta. If you are able to obtain information on this subject, which you think likely to be useful, perhaps you would have no objection to embody it in the form of a memorandum, which I could lay before the Governor General.

Calcutta : May 28th, 1845.

To Cecil Beadon, Esq., *Under-Secretary to Government, Fort William.*

My dear Sir,—In compliance with your request of the 28th ultimo, I have now the pleasure to state, for the information of the Governor General, the following particulars regarding the quality and quantity of walnut tree wood procurable in the neighbourhood of Darjeeling, especially with reference to its fitness for gunstocks.

2. The walnut tree,—called by the Lepchas *Koe Koong,* by the Bhotiahs *Ságá,* by the Limboos *Keshe,* by the Nipalese *Wokur,* Hindoostani *Akrot,* Persian *Charmaghry,*—here grows to the height of fifty or sixty feet; with a straight, branchless stem and wide-spreading head, attaining a circumference of six to nine feet. The bark is of whitish colour; rough, deeply indented, and used rather extensively in the purple dye from munjeet. There is but one species I believe; but whether it is the same as the common English walnut "Juglans regia," I am not competent to determine.

3. It abounds on the Lebong Spur, close to Darjeeling; is generally found in the Sikim mountains, and those of Eastern Nipal, and throughout Bootan—at elevations of 3 to 7,000 feet above the level of the sea. It is most abundant at elevations of 4 to 5,000 feet, and is rarely, if ever, found indigenous at higher altitudes than 7,000 feet. At Darjeeling itself, elevation 7,200 feet, there are some trees which perhaps have been planted by former occupants. At the lower eleva-

tions its growth is described as very rapid, but I have no means of ascertaining the rate of its growth at the higher ones, where it is said by the natives, as we should naturally expect, that its progress is slower and the wood of better quality.

4. It flowers in April and May, and ripens its fruit in September and October. The shell is thick, deeply furrowed, and of a sharp oval shape. The kernel small, difficult to get at, but sweet.

5. In Bootan, however, where the species is probably different, the nut is smooth, roundish, and thin-shelled, and the kernel large, and of fine flavor, inferior only to the Cashmeer and Caubul one.

6. The wood of our tree has not hitherto been tried for gun-stocks; but it has been used in cabinet work and house carpentery, for which it is well suited; being prettily veined, light, and susceptible of a good polish. A specimen fusil-stock has this day been forwarded to your address by dâk banghy. I hope to hear that it may be approved of, and that a trial of these stocks may be considered advisable.

7. The wood may be procured in very large quantity; but without actual experiment, it cannot be determined at what cost it could be delivered in Calcutta. The wages of labour in cutting down the trees, sawing, fashioning, and transport, would comprise the total cost. The item of carriage would be considerable. I would therefore suggest, if the experiment is deemed advisable, that the stocks be made here in light block, leaving the barrel, and lock-fittings, and polishing to be done at the arsenal of Fort William. This would greatly reduce the cost of carriage, compared with that on logs, and facilitate transport on bullocks and *tatoos*, the cheapest and quickest mode in the hills.

8. The quickest and most effectual method of making the experiment would be, to authorize the expenditure of a small sum, say Rs. 300, in making and sending to Calcutta, stocks in light block. My own attention and Captain Bishop's would be sedulously given to see the experiment made quickly and with the utmost economy; and according to the result, future supplies, if desired, might be procured through the Executive Officer, or by contract. I speak without correct data, but I think that the stocks might be delivered in Calcutta under Rs. 1 : 8, each.

9. The cold season is the best for cutting down the timber; but it would not be necessary to wait for that time to try the experiment as to the cast of the stocks, although, if it become necessary to furnish large and regular supplies of them, it would be advisable to cut the timber at that season when the sap is at most rest.

10. Any further particulars you may require on this subject, pray give me an opportunity of communicating.

Darjeeling: 6th June, 1845. (Signed) A. CAMPBELL.

To A. CAMPBELL, ESQ., *Darjeeling.*

"I beg you will accept my best thanks for your letters of the 2nd, 6th, and 9th instant, which I only delayed acknowledging until the specimen gunstock should arrive. It came to hand yesterday evening, and to-day I shall have the pleasure of laying it, and your valuable communications, before Sir Henry Hardinge, with whose wishes on the subject you shall be further acquainted. The wood seems to be of excellent quality, and remarkable for its lightness. I am surprised the subject has not attracted attention before this; perhaps it has done so, though I can find no trace of it. Captain Pemberton just mentions the fact that the walnut grows in Bootan, and in one of the volumes of the Agricultural Society's transactions, there is casual mention of walnut timber being found in Nipal. The difficulty of supplying walnut timber to the arsenals in England is now so great, that the Ordnance are seriously thinking of substituting some other wood for it, to the great discomfort, of course, of the soldier, and detriment to his efficiency. Now if India could supply the English army, and by consequence other armies, with timber for gunstocks, it would, of course, become a very important and valuable staple of our export trade. I will take measures to ascertain the value of the other kinds of timber which you mention as having been sent by dâk banghy."

Calcutta: 19th June, 1845. (Signed) C. BEADON.

To A. CAMPBELL, ESQ., *Darjeeling.*

"The annexed note is not very favorable for the Darjeeling walnut, but perhaps you may be able to send a more valuable speci-

men. You will also be able to ascertain, how far the conjecture as to the wood being of the branch and not of the trunk is correct. There can be little doubt, that if walnut timber, equal to that grown in England, is found in this country, in sites where carriage is available, it will prove an immense acquisition."

Calcutta : 8th July, 1845. (Signed) C. BEADON.

"I suppose we shall receive the report to-morrow or the next day.

"I understand the stock is not considered a valuable product. The wood is soft and easily indented. The stock is supposed to be made out of a branch, and not out of the wood of the stem. However, we shall receive the report in a day or two."

MODE OF PREPARING SEEDS FOR TRANSMISSION TO INDIA, AND OF PRESERVING THEM AGAINST THE RAVAGES OF INSECTS.

Extract of a letter from CAPT. HUGH ROBISON, *dated Aurungabad, 13th November*, 1846.

"I do not know if the following is worth communicating; but a few years since, when I was at home, I got some seed (vegetable) which I put into phials, which were all immersed in water at 100°, and these corked, and sealed, and sent to Bombay by sea: by the above process, I proposed to expel all the moisture that would be exhaled in the bottles from the seeds in the hold of a ship, which usually destroys seeds, when bottled or otherwise closed from the external air. The result looked like success, for though I did not get them to sow, for a twelvemonth, all succeeded perfectly; but as I have not had the experiment repeated, I do not exactly say the result was a proof of the efficacy of the plan—but I think it very probable.

"Another experiment I tried last year is this—Having a larger stock of marrowfat peas than I required for the season, and having usually lost such overplus in former years by the insects, I threw what remained into a strong arsenical wash for 20 minutes, and then

exposed them till perfectly dry again, and so put them by for this season, and completely got quit of the insect, and now the seed is growing, and from which I have had two crops. Of course I took care to prevent any one using any of them."

REPORT OF AN EXHIBITION OF VEGETABLES AND FLOWERS HELD BY THE BHAUGULPORE BRANCH AGRI-HORTI. AND FLORICULTURAL SOCIETY. (COMMUNICATED BY MAJOR T. E. A. NAPLETON, SECRETARY OF THE SOCIETY.)

On Monday evening, the 23rd of November, 1846, the first exhibition for 1846-47, of flowers and vegetables, took place in the public garden. Nearly the whole of the ladies and gentlemen of the station, together with some visitors from adjacent places, and several native gentlemen honored the meeting with their attendance.

The tables in the show room were completely covered with the floricultural and vegetable produce of the season.

Two committees were formed for awarding prizes, and simultaneously commenced testing the specimens in the above departments. Mrs. Watson, Miss Russell, and Mr. Hodgson kindly adjudged the prizes in the former, and Dr. Grant, Mr. Glover, Mr. Wallace, and Baboo Gooroo Churn Mitter, obligingly acted as judges in the latter.

The bouquets of flowers, consisted of a fine display of roses of six varieties, of heliotrope, verbena, a few passifloras, silver creeper, geranium of six sorts, honeysuckle, sweet briar, myrtle (one bouquet of that favorite flower having been gathered from a plant brought out in the *Agincourt* and presented to the Society by Captain Nisbett), tecoma stans in great beauty, double daisies, russelia floribunda, poinsettia, galardia picta, dahlias, ipomœa rubrocœrulea, thunbergia grandiflora, mignonette, zinnias of favorite colors, plumbago capensis and three other varieties, abutilon striatum, *cum multis aliis*. There was also a fine assortment of exotics from the garden of R. F. Hodgson, Esq., Civil service, Monghyr.

In the vegetable department there were some early cauliflowers, vegetable marrow, peas, beet root, mangul wurzul, French beans, turnips, carrots, onions, lettuce, endives, new potatoes, love apples, Jerusalem artichokes, Tenasserim yams, West and East India arrow-root, red turnip radishes, asparagus, Cabool capsicums, leeks, and several baskets of indigenous vegetables.

In this department a fine basket of new potatoes, raised from Cherra Poonjee seed, in the Society's Garden, particularly called forth the praise

of the umpires, and they pronounced the whole of the vegetables of the public garden to be of the most satisfactory order. With reference to the rainy season having been prolonged this year to an unusually late period, the produce of vegetables from private gardens, was also considered good; but those brought from the garden of John Glass, Esq., were considered far in advance of all others, and the umpires requested the circumstance to be noticed in this report.

Prizes to the amount of 40 Rupees were awarded by the two committees.

To the Mali of Captain Don, several small prizes for a bouquet of roses, sweet briar, mignonette and zinnias of favorite colors; also for peas, early potatoes, Jerusalem artichokes, and love apples.

To the Mali of John Glass, Esq., for the best chrysanthemums, and double daisies; also for early cauliflowers, asparagus, Jerusalem artichokes, French beans, turnips, and Tenassorim yams.

To the Mali of James Pontet, Esq., for the best specimens of verbena, lavender, and geraniums of six sorts.

To the Mali of G. F. Brown, Esq., for Jerusalem artichokes, celery, beet root and leeks.

To the Mali of Cleveland House garden, for the best bouquets of roses, sweet briar, heliotrope, myrtle; also for the best celery, carrots, turnips, lettuce, and endive.

Several small prizes were awarded to the gardeners of Baboo Gooroo Churn Mitter, Baboo Oomanauth Ghose, Mudden Thackoor, Sergeant Major Smith, Quarter-Master Sergeant J. Dowling, Shah Enayut Hoossain, and Moonshee Waris Ullee, for early cauliflowers, endive, beet root, Tenasserim yams, Cabool capsicums, peas, indigenous vegetables, &c. &c.

This opportunity is taken of notifying the following donations to our Branch Society since the 1st of June last.

A money donation of twenty Rupees from J. Duhan, Esq., Bhaugulpore.

A donation of some Hubshee raisins from James Ralph, Esq., Pay and Postmaster, Aurungabad.

A packet of fresh coffee seed from Colonel Ouseley, Governor-General's Agent at Chota-Nagpore.

From Walter Landale, Esq., Futtypore, about 4 maunds of superior acclimated Nerbudda wheat (produce of his farm) for the public garden sowings, and for distribution to agriculturists.

The sum of one hundred Rupees from R. Lowther, Esq., Civil service, Allahabad, who has compounded for his subscription.

From John Brown, Esq., Bhaugulpore, a number of rare fruit and other young trees, brought by him from Penang in the finest possible order. The mangosteen is amongst them.

A fine collection of orchideous plants, from Captain George Cox, 60th Regiment, collected at Darjeeling, and received in beautiful order.

A few of the finest Malda mangoo grafts from the Hon'blo F. Drummond, Civil service, Malda.

From Baboo Gooroo Churn Mitter, a bottle of cauliflower seed.

From the Honorary Secretary, several hundred choice flower plants and cuttings, 40 leechee grafts, several rose-applo, citron, and lime grafts.

A few choice apple grafts from J. Finch, Esq., Tirhoot.

From C. D. Russell, Esq., Civil servico, several choice flower plants and flower seeds.

From James Fulton, Esq., of Sultaugunge, 12 fine and healthy Assam tea plants.

From A. Arrouch, Esq., several violet plants.

From R. Lowther, Esq., Civil service, Allahabad, a plant of the Aristolochia indica, (the snake-plant.)

List of new subscribers since the last show, held on the 1*st June,* 1846.

Moulvee Ushruff Ullee, Mozuffurpore, Tirhoot.

Gopaul Lall, Mozuffurpore, Tirhoot.

J. E. S. Lillie, Esq., Civil service, Patna.

R. Money, Esq., Civil service, Humeerpore.

H. N. Elton, Esq., Civil surgeon, Goruckpore.

C. R. Crommelin, Esq., Tirhoot.

T. Gibbon, Esq., Tirhoot.

Baboo Khettru Mohun Mookerjie, Deputy Collector, Bhaugulpore.

C. H. West, Esq., Tirhoot.

James Ralph, Esq., Aurungabad.

John Mackenzie, Esq., Tirhoot.

James Thomson, Esq., Tirhoot.

Colonel Story, C. B., 9th Cavalry.

T. H. Elliot, Esq., Civil service, Mooteharee, Tirhoot.

J. Beaufoy Grisenthwaite, Esq., Darjeeling.

Captain R. F. Grindall, Gyah.

Moulvee Mahomed Majid Khan, Bahadoor, Principal Sudder Ameen, Bhaugulpore.

Moulvee Mahomed Muhamid Khan, Sudder Ameen, Mozuffurpore, Tirhoot.

R. F. Cahill, Esq., Tirhoot.

J. Lynch, Esq., Tirhoot.

Maynard Howell, Esq., Tirhoot.

R. N. Shore, Esq., Civil servico, Bhaugulpore.

George Mitchell, Esq., Tirhoot.

Baboo Bhugwan Doss, Bhaugulpore.
Robert Lowther, Esq., Civil service, Allahabad.

For all the above donations and the support the Society continues to receive from nearly 250 subscribers, the best thanks and acknowledgments of this our Branch Society are hereby accorded.

By order of the Garden Committee,

(Signed) T. E. A. Napleton,
Honorary Secretary,
Bhaugulpore B. A. H. and F. Society.

ON THE DISTINCTION BETWEEN THE DORMANT AND ACTIVE INGREDIENTS OF THE SOIL. BY DR. DAUBENY.

In the Bakerian Lecture for 1845,* I took occasion, whilst treating of the Rotation of Crops, to insist upon the distinction between what may be termed the *dormant* and the *active* ingredients of a soil with reference to the plants that grow in it.

When we consider, I remarked, the nature of a soil in an agricultural point of view, or in reference to its suitableness for the growth of various kinds of vegetables, two questions naturally come before us; namely, what amount of ingredients, capable of being assimilated in the course of time by the crops, does it contain; and secondly, what is the amount of those which are present in a condition to be actually available for their purposes, at the precise moment when the examination is undertaken.

Both the above points are obviously quite distinct from that relating to the total amount of ingredients which exist in it, and hence some might be disposed to add to the labor of the two preceding investigations, that of ascertaining the whole of its constituents, whether in a state to be affected by the ordinary agents of decomposition, or not.

The latter question, however, seems to me to possess, with reference to the agriculturist, only a speculative interest, and when introduced into a report intended for his use, may be more liable to mislead than to instruct, unless due caution be taken to point out to him, how much of each ingredient is to be regarded as inert, and how much of it as applicable to the future or present uses of the plant.

Let us take the case of a natural soil, composed of certain kinds of disintegrated lava, or even of granite, in which it is evident, that an actual analysis,

* Philosophical Transactions, Part ii. for 1845.

conducted by means of fusion with barytes, or lead, or by any of those other processes which chemists employ for decomposing compounds of a refractory nature, would detect the presence of a large percentage of alkali, not improbably of a certain amount of phosphate of lime, and in short of all those ingredients which plants require for their support in sufficient abundance. Nevertheless, land of this description, in consequence of the close union of the elementary matters of which it consists, and the compactness of its mechanical texture, might be as barren, and as incapable of imparting food to plants, as an artificial soil composed of pounded glass is known to be, notwithstanding the large proportion of alkali contained in it.

Thus I have myself observed,* that the soil which covers the serpentine rock of Cornwall, although the latter is principally made up of a mineral consisting of—

Silica	43·07
Magnesia	40·37
Alumina	0·25
Lime	0·50
Oxide of iron	1·17
Water	12·45—HISINGER.

contains, nevertheless, so minute a proportion of magnesia, that in an analysis of a small sample its presence had been altogether overlooked by me, in so great a degree may the mechanical condition of the components, and the state of combination subsisting between them, preserve a rock from the decomposing action of the elements which tend to set loose its treasures.

Now it seems obvious, that whatever cannot be extracted from a soil by digestion in muriatic acid during four or five successive hours, must be in such a state of combination as will render it wholly incapable of imparting anything to a plant, for such a period of time at least as can enter into the calculations of the agriculturist; and moreover, that all which muriatic acid extracts, but which water impregnated with carbonic acid fails in dissolving, ought to be regarded as at present contributing nothing, although it may ultimately become available for its purposes.

I have therefore thought proper to distinguish between the immediately available resources of the soil, and those ultimately applicable to the uses of the plant, designating the former as its *dormant* and the latter as its *active* ingredients.

The portion dissolved after digestion in muriatic acid will contain both the *dormant* and the *active;* that taken up by water impregnated with carbonic acid will consist merely of the latter; the difference in amount between the two will therefore indicate the *dormant* portion of its contents.

* Lecture on the Application of Science to Agriculture, from the Journal of the Royal Agricultural Society of England, Vol. iii., part i.

The *dormant* and *active* portions may both be comprehended under the designation of its *available* constituents, whilst those which, from their state of combination in the mass, can never be expected to contribute to the growth of plants, may be denominated the *passive* ones.

Every soil which is capable of yielding an abundant crop of any kind of plant after fallowing, must be assumed to possess in itself an adequate supply of all the ingredients necessary for its support in an *available* condition; but it is plain that these could not have existed in an *active* one, or such an interval of rest would not have been required for rendering them efficient.

Accordingly it is quite possible, that after ten years' cropping, the soil of my experimental garden might still retain plenty of alkaline salts and phosphates, although what was ready to be applied to the uses of the plant had for the most part been absorbed by the crops previously obtained.

With a view then to this branch of the inquiry, I first ascertained the nature and amount of the ingredients separable from a given weight of the soil by means of muriatic acid; and 2ndly, those obtained from the same by a definite quantity of water impregnated with carbonic acid gas. By a careful analysis it was ascertained that the soil of the Botanic Garden at Oxford contained, within an area of 100 square feet, and a depth of 3 feet from the surface, 3·5 lb. of phosphoric acid, 6·9 lb. of potass, and 2·9 lb. of soda, all in a state to be separated from the general mass by muriatic acid.

That the above, however, were for the most part in a *dormant* condition, appeared from the much smaller amount of the same which could be extracted by water containing carbonic acid, for it was found that of alkaline sulphates* not 11 lbs. could be procured by these means, whereas

6·9 lb. of potass would have formed	12·7
2·9 lb. of soda	6·5
Together ...	19·2 lb.
Extracted by carbonic acid water ...	11·0 „
Difference ...	8·2 „

and that of phosphate of lime only 7134 grs., or less than 14 ounces were obtainable; whereas 3·5 lb. of phosphoric acid, equal to near 7·0 lb. of phosphate of lime, had been taken up by muriatic acid from the same.

By operating in a similar manner upon soils of the same quality as the above, which had been exhausted by several years' previous cropping, it appeared, that whilst the amount of the ingredients alluded to as *dormant* in the soil did not much vary in the two cases, that of the *active* ones was beyond all comparison greater in the sample of unexhausted soil.

This will appear from the following table :—

* The alkalies were estimated as sulphates, as it was found convenient to unite them with sulphuric acid, in which state they admitted of being heated and weighed without incurring loss.

Table of the Quantity of Alkaline Sulphates and Earthy Phosphates extracted by means of Water impregnated with Carbonic Acid from the Soils enumerated below.

Soil examined and treated with water.	Quantity of water added.	Quantity of alkaline sulphate obtained.	Nature of the alkali.	Quantity of alkaline sulphate per quart of water.	Quantity of alkaline sulphate in 1 lb. of soil.	Quantity of alkaline sulphate in 100 square ft. (24,600 lbs.) of the soil.	Quantity of earthy phosphate taken up.	Quantity of earthy phosphate per quart of water.	Quantity of earthy sulphate per lb. of soil.	Quantity of earthy phosphate in 100 square feet of soil. (24,600 lbs.)
	qts.	gr.		gr.	gr.	gr.	gr.	gr.	gr.	gr.
From the contiguous garden, first time ...	2	5·2	Potass.	2·6	..	...	0·7	0·35		
From the contiguous garden, second time ...	2	7·8	Potass.	3·9	...	...	0·7	0·35		
From the contiguous garden, third time ...	1	3·4	Potass.	1·7	...	...	0·05	0·05	0·29	7134
From the contiguous garden, fourth time ...	1	2·6	Potass.	1·3	3·4	83,640				
From the permanent bed of barley	2	0·6	Soda.	0·30	0·12	2,950	0·30	0·15	0·06	1470
From the permanent bed of potatoes	2	0·7	Soda.	0·35	0·07	1,700	0·25	0·125	0·05	1200
From the permanent bed of hemp	2	0·6	Soda.	0·30	0·12	2,950	Scarcely appreciable.			1470
From the permanent bed of flax	2	0·5	Soda.	0.25	0·10	2,450	Scarcely appreciable.			2940
From the permanent bed of turnips	2	0·6	Soda chiefly.	0·30	0·12	2,950	0·30	0·15	0·06	3180
From the permanent bed of beans	2	0·5	Soda.	0·25	0·10	2,450	0·60	0·30	0·12	4900
From the shifting bed of barley	2	0·7	Soda chiefly.	0·37	0·07	1,700	0·065	0·0325	0·013	3420
From the shifting bed of potatoes	2	1·0	Soda chiefly.	0·50	0·20	4,900	0·100	0·050	0·020	4900
From the shifting bed of hemp	2	1·0	Soda chiefly.	0·50	0·20	4,900	Scarcely appreciable.			
From the shifting bed of flax	2	0·3	Soda chiefly.	0·15	0·06	1,470	0·7	0·35	0·14	3420
From the shifting bed of turnips	2	3·6	Potass.	1·8	0·72	17,700	0·9	0·45	0·18	4410
From the shifting bed of beans	2	1·0	Soda.	0·50	0·20	4,900	0·30	0·15	0·06	1470

From these facts, and from others stated in the course of my memoir, I have conceived myself warranted in deducing the following conclusions :—

1st. That it is quite consistent with the general tenor of the preceding facts and observations, to maintain with Boussingault, that the falling off of a crop is dependant as well upon a deficiency of organic matter proper to promote the nutrition of the plants, as upon a failure of its inorganic principles; not indeed that the organic matter enters, as such, into the constitution of the vegetable, but that by its decomposition it furnishes it with a more abundant supply of carbonic acid and ammonia, which supply accelerates the development of its parts, and thus at once enables it to extract more inorganic matter from the soil, and enables the soil to supply it more copiously with the principles it required for its nutrition.

Hence, perhaps, in part, the advantage of intercalating the Leguminosæ and other fallow crops, which generate a larger amount of organic matter than the Cerealia, and which thus serve to enrich the soil by what they leave behind them.

2ndly. That it by no means follows, because a soil is benefited by manuring, even though that manure may, as in the case of bones, guano, &c., derive its efficacy from the phosphates it supplies, that it is therefore destitute of the ingredient in question, since it may happen that it possesses abundance of it in a *dormant* though not in an immediately *available*, condition.

In these cases, in which the agriculturist has been assured by the results of actual analysis, that there is no real dearth of the principles essential to his crops in the soil under cultivation, but where he has ascertained, either by the chemical mode pointed out, or by an experience of the good effects brought about by manures, that the substances in question are not in a state to become immediately applicable to the purposes of vegetation, three courses appear to be open to him :—

1st. To apply a sufficient quantity of the same materials in a state in which they can be absorbed by the plants without delay; 2ndly, to allow the ground to remain fallow, by which expedient time is given for a further decomposition of its materials, and for a renewed extrication of its useful ingredients, to take place; 3rdly, to produce, by the various methods in daily use, such a stirring and pulverization of the ground, as may admit of a more thorough admission of air and moisture, and consequently accelerate the process of disintegration in a greater degree than would take place under natural circumstances.

Examples will occur to every one of the successful adoption of each of these three practices: of the first, in the ordinary process of manuring, and especially in the beneficial consequences resulting from the use of bones in the exhausted pastures of Cheshire and other similar localities; of the second, in the system so general in the early stages of agriculture, that of allowing land to remain at rest for a certain period with a view of restoring

to it its exhausted powers,—a method which would be absurd, if the alkalies, phosphates, and other of the more scanty ingredients were absolutely wanting, but which would be likely to prove efficient, if they were only locked up within the recesses of the soil, and required time to call them into activity; of the third, in the practice resorted to by Jethro Tull, who boasted that he could realize an abundant crop, year after year, without manure, provided the ground were sufficiently stirred and broken up,—a statement which seems confirmed, by some of the results of spade husbandry, and in a certain degree by those detailed in this paper, with respect to the permanent crops which are herein mentioned as having been made the subjects of experiment.

The choice between the above three methods will of course be determined in each instance by a balance of economy; and although in general this latter consideration will incline the farmer to prefer the ordinary method of manuring, either to the sacrifice of a year's produce, as in the second method, or to the expenditure of labor required to put into practice the third, still there may be cases where it might better answer his purpose to resort to one or other of them, as being more advantageous in itself, or else more suitable to the circumstances of his case.

At any rate it may be important for him to be assured, that at the very time he is ransacking the most distant quarters of the globe for certain of the mineral ingredients required for his crops, he has lying beneath his feet in many instances an almost inexhaustible supply of the same.

For there seems no reason to doubt, that the whole mass of rock, which constitutes the subsoil in the secondary and tertiary districts of this country, is nearly as rich in phosphates and in alkalies as the vegetable mould derived from its decomposition; and although the soil, in which the experiments in my garden were conducted, possessed a depth perhaps three times as great as the average of those in which farm produce is generally raised, yet, on the other hand, the amount of phosphates and of alkaline ingredients reported to be present in the latter appears in many instances greater than that determined in the case before us.

Thus Dr. Ure* gives an analysis of a soil in the parish of Hornchurch, Essex, which contained four grains of phosphate of lime in 1000 grains; whereas, of ours, the same quantity yielded little more than one-fourth of a grain; and if the former be regarded as an exceptional case, I might have referred to Sprengel, who states that the percentage of phosphoric acid in the soils he analysed varied from 0·024 to 0·367; and in the subsoils from about 0·007 to 0.2.

I detected many years ago phosphate of lime in several secondary limestones, chiefly taken from the oolitic formation, and Mr. Schweitzer of Brighton has determined the proportion of that ingredient in the chalk near

* Journal of the Royal Agricultural Society.

Brighton, to be not less than one grain in the 1000. We need not therefore resort to South America for bones, if means could be found for extracting this ingredient economically from the rocks of our own country.

3rdly. These facts place in rather a new light, although one, it is conceived, not less striking than before, the importance of taking care of the various excrementitious matters at our disposal, whether proceeding from animal or from vegetable sources.

Such substances indeed contain the products which nature has, with so large a consumption of time, and by such a number of complicated operations, elaborated from the raw material contained in the soil, and has at length brought into the condition, in which they are most soluble, and therefore best fitted to be assimilated by the organs of plants.

To waste them is therefore to undo what has been expressly prepared for our use by a beautiful system of contrivances, and to place ourselves under the necessity of performing, by an expenditure of our own labor and capital, those very processes which nature had already accomplished for us, without cost, by the aid of those animate or inanimate agents which she has at her disposal.

4thly. The analyses above reported may suggest caution as to the inferences which some might be disposed to deduce from certain researches lately announced, with respect to the power which a plant possesses of substituting one alkali, or one earth, for another in the processes of vegetation.

This substitution indeed, however brought about, is a fact which hardly admits of being questioned, supported as it is by the testimony of men so eminent as Saussure and as Liebig; and indeed many of the analyses detailed by me in the Philosophical Transactions might be appealed to in corroboration of its truth.

Thus we find, that whilst the amount of bases agreed pretty nearly in the three crops of the same plant which had been analysed, the proportions between them often varied considerably. This is particularly seen in the case of the lime and magnesia, the deficiency in one of these earths being often made up by an excess in the other.

In like manner a deficiency of potass is found to be compensated by an increased amount of soda, and the same remark seems to apply to the acids.

Still we have not as yet sufficient data for determining to what extent this exchange of the usual ingredient for another can take place; whether indeed the same organ, or the same proximate principle belonging to the plant, may admit at all of this change in its constitution taking place; or if it can, in what degree the presence of this new principle may affect its healthy development.

By turning to the Table which states the relative quantities of alkaline ingredients extracted by water impregnated with carbonic acid from the different soils, it will be seen, that in most of those the amount of soda

predominated over that of potass, and yet the latter alkali was principally found in their ashes; an indication at least of some superior adaptation of potass to soda with reference to the organization of plants.*

Again, it is remarkable, that whilst in several of the soils soda appeared to exist in the form of a carbonate (since the quantity of chlorine was so small that only a minute trace of it was discoverable in them), in many of the ashes of the plants only as much soda was detected as would contain sodium equivalent to the chlorine present.

Hence it would seem to follow, that common salt, when it acts beneficially upon land, does not assist the crop by virtue of the alkali it imparts to it, but operates in some other as yet unexplained way; and that it is still questionable, at least in the case of terrestrial species, whether plants have the power of decomposing chloride of sodium, and of separating its chlorine.

Lastly, the analyses contained in this paper may be of use at the present moment, by contributing to show how much still remains to be done, before we can flatter ourselves at having attained any sure knowledge of the normal constitution of plants, or of the range of variation of which under natural circumstances it is susceptible. At a time when certain enlightened members of the Royal Agricultural Society have prevailed upon that great body to devote a portion of their funds to the prosecution of the chemical analysis of the ashes of vegetables, whatever tends to render more palpable the importance of such an investigation may be of service, in aiding their meritorious efforts to give a more scientific direction to the inquiries which such Associations are intended to promote, and in vindicating the utility of the course which they have in this instance adopted.

Now the facts and observations detailed in the present paper contribute in two respects towards this object, viz., 1st, by showing that the composition of the most commonly cultivated plants is still open to much uncertainty; and 2ndly, by pointing out in what way an exact knowledge of their inorganic ingredients might aid us towards the solution of many important practical questions.

I hope it will not be attributed to any blindness on my part to the deficiencies and imperfections which exist in this paper, if I remark, that an investigation of a similar kind to the one herein detailed, if carried out on a more adequate scale, undertaken on ground more carefully selected, conducted with a more vigilant attention to all the minute circumstances which might influence the result, and accompanied by a regular series of analyses, both of the soil and of the crops, during the whole period of their continuance, would be of essential service in clearing up many points in agricultural science which yet remain questionable.

* This is also shown very strikingly in a paper on the analysis of Fuci read to the British Association at Cambridge, by Mr. Schweitzer, in June, 1845.

My memoir may serve also as a kind of illustration of that method of scientific book-keeping, which I proposed sometime ago, at once as an useful exercise for the agricultural student, and as a means of introducing greater precision into the conduct of our experiments on this subject, and which I am therefore happy in having this opportunity of rendering more generally known and understood.—*(From the Journal of the Royal Agricultural Society of England, Vol. vii.* 1846.*)*

EXPERIMENT AT PROPAGATING PLANTS BY LEAVES. COMMUNICATED BY A. H. CHEEK, ESQ.

To JAMES HUME, ESQ., *Honorary Secretary, Agricultural and Horticultural Society.*

DEAR SIR,—In 1844, I procured two small plants of *Hoya carnosa*, commonly called the "*wax-plant*," from Mr. Hudson, of Barrackpore, which I brought with me to this station, (a distance of more than 700 miles,) where from the dryness of the climate compared to that of Bengal, (as I imagine) one died away, and the other was visibly drooping; anxious to preserve a specimen of the plant, and knowing that experiments of propagation by leaf had been successful, I took a strong and healthy leaf which I planted in a flower-pot, with rich black mould, hoping it would take root and thrive; the result has proved, as I so much wished, and the stem of the leaf planted in October, 1845, has shot forth roots which are now spreading in every direction, although as yet nothing has appeared above ground. It having thriven so well for upwards of a year, and lived through the hot-winds (during which time it was placed under the shade of some plantain trees near a well) prognosticates well for its future growth: if this be an uncommon system, and one worth trying in India, where seeds are so liable to be injured by damp, I shall be happy to furnish you with further accounts of the progress of my experiments.

I am, &c.

(Signed) A. H. CHEEK, *Surgeon,*
Sindia's Contingent.

Lullutpoor, viâ Saugor.

P. S.—Some orange leaves that were planted at the same time with that of Hoya carnosa, lived from October till April, when they were destroyed by the hot-winds: however, this year I shall take precautions against such an event occurring.

ON THE PROPAGATION OF PLANTS BY LEAVES.

(From the Gardeners' Chronicle, for 1845.*)*

There is one point in the History of Propagation which surpasses all others in its interest and importance, but which can scarcely yet be said to excite in this country the attention it demands. We mean the multiplication of plants by leaves. Gardeners unskilful in the art of striking cuttings, find it difficult to manage successfully anything more untractable than a Pelargonium, and fancy the propagation of hard-wooded plants by cuttings altogether impossible. As to leaf-striking, it is not thought of.

Gardeners are not to be blamed for this; physiologists, who should have directed them, have not given to the phenomena of leaf-propagation the consideration that they deserve. In DeCandolle's Physiology the subject is dismissed in two or three pages; and although the theory of the matter is touched upon by that author, he by no means embraces the main points included in it. And in the Theory of Horticulture, where it occupies a chapter, the manifest error has been committed of assuming it to be probable, that "although many leaves may be used for the purpose of propagation, yet that the greater part, when separated from their parent, are incapable of being so."

When that strange compound of knowledge and quackery "Agricola's Husbandry" was translated by Bradley, the gardeners of the day must have regarded the author as a romancer, for he gravely assured them that all manner of trees may be multiplied by their leaves; and in corroboration of the assertion, he represents in one of his copper-plates a field actually planted with the leaves of oranges and lemons. This plate illustrates, as he says, "how by means of fire and mummy, leaves, twigs, buds, and branches may be turned into shrubs and trees, by planting them in the ground."

"Having observed," he adds, "that the leaves of some plants may very well be used instead of joints or shoots, I shall now undertake to show how the leaves take root. The curiosity for cultivating vegetables, it is well known, has long since been carried so far as to occasion an attempt to raise a tree from a leaf, just as F. Mandirola made the experiment with a lemon-tree-leaf.

His words upon this subject, taken out of his writings, are as follows:—'I tryed a masterpiece, to wit, to plant citron, lemon, and such like leaves after the following manner. I took for that purpose a sort of little flower-pot full of the best-sifted earth; I planted in it some leaves of those kinds of trees, with their stalks so deep that the third part of the leaf was covered with earth; over that pot I fastened a small pitcher full of water, so as that it might drop directly down into the middle of the pot, and the hollow which was made by the falling of the drops I continually filled up with fresh earth; thus they cost me but a little trouble, and they all shot up and grew very well. I pursued it with the greatest patience in the world, and found that through a too often dropping of water, the leaves began to rot, and so wasted away of themselves by little and little, so as that at last nothing was left but the stems; but it having been observed since, that from the callous matter that came forth at the bottom, both roots and branches shot out; it appears that *all exotic leaves* may at any time be converted into trees. For this operation I make choice of the months of July, August, and November; but those who have stoves and greenhouses may perform it even in winter, and in that case they shoot the better in the spring. Those who have a mind to do it in the spring will have some success; but it is not so very sure, which ought to be chiefly ascribed to the inconstancy of that season.'"

This statement, made in the year 1721, is very remarkable on many accounts. To be sure, the enthusiasm of the worthy Dutchman did run away with him; and it must be confessed that he could have had little notion of what is possible in the vegetable world when he flattered himself that orange and lemon groves might be created by sticking their leaves in the open fields. Nevertheless, his speculations were founded on very important facts, and are connected with properties in leaves which we are only just beginning to recognise.

We never heard of any one striking orange-trees from their leaves, but we entertain no doubt of the possibility of the thing; for although in this country we rarely attempt to apply the practice to any sorts of leaves except those of a fleshy texture, like gloxinias, gesneras, &c., yet Mr. Neumann tells us that the hard and dry-leaved theophrasta latifolia has been struck by him in this way; and what is more, that when the leaf was cut into two halves, the one half struck root as well as the other. It will be obvious to all who know what a theophrasta is, that if such a leaf as that may be made to strike root, there can be no conceivable difficulty in obtaining the same result from the leaves of oranges, lemons, sweet bays, rhododendrons, hollies, or any other sort of evergreen. The difficulty will reside in the varying structure of such plants, and the consequent uncertainty about the peculiar treatment which each leaf may demand. What may be extremely proper in one case will be destructive in another. Experience is therefore wanted; and numerous experiments must be made to determine the details of such a practice. But

those experiments will have a better chance of leading quickly to success, if the theory of the action of leaves is understood.

No plant can form a new individual without first organizing a bud. That *must* be in all cases the first step in the process of propagation. Now buds are known to spring exclusively from the soft pulpy or cellular matter that constitutes tho flesh of plants, and not from their solid woody (or bony) parts. This cellular matter is formed by nature out of organizable fluids produced by the leaves, and by the leaves only, or their equivalent, as in the instance of the green bark of the leafless cacti. Hence it follows that leaves are really the great agents of propagation in any case, whether layers, cuttings, or other forms of multiplication are had recourso to; for the power possessed by the parts of plants so named is derived immediately and exclusively from the leaves. No wonder, then, that leaves should themselves become agents of propagation.

But leaves in their natural state are connected with the stem by a peculiar and admirablo mechanism, which insures their being continually and abundantly supplied with food out of which they may prepare the organizable matter that is in the first instance to engender cellular substance and afterwards a bud. If this mechanism is disarranged the leaf dies, or becomes unhealthy, and loses its bud-creating power. No disturbance of the mechanism in question can well be greater than that which separates the leaf from its stem, and therefore the chances of the leaf dying are increased in proportion. But if, notwithstanding the separation of a leaf from its supply of food, means can be found to nourish it in some other manner, it may be kept alive; and if its vitality can only be preserved long enough, it must necessarily go on forming cellular matter, which again will oboy that irresistible impulse which compels a bud to be engendered; and the bud being formed, a new plant will follow as a matter of course.

The problem to solvo is how to nourish a leaf as well as it was nourished by its parent. To that question propagators have exclusively to direct their attention, for there is no fact more certain in nature than that if the supply of proper food to a leaf is but kept up, form a new plant it inevitably must. What the manner is of doing this will be the subject of consideration another week.

Striking the leaves of plants is not, as at first sight may appear, a process more curious than useful. It is quite conceivable that it may become of the highest horticultural interest. Mr. Barnes, of Bicton, in another column, has suggested that the camellia would be much improved if it was grafted on a better stock than that which is commonly employed, viz., the single red; and he remarks that the unhealthy condition of camellia reticulata itself is also undoubtedly owing to its dislike of that particular stock. He is probably right; and it would be desirablo to ascertain, firstly, whethor camellia

reticulata will not grow better if not grafted at all; and, secondly, whether it would not make a far better stock for the others of its race. But if this should prove to be so, there will remain the difficulty of getting camellia reticulata cheaply enough to be used as a stock. Striking its leaves offers the only means of doing so; and there should be no greater difficulty in operating on it than on a theophrasta.

This is, we trust, a sufficient reply to a correspondent who criticises the statement made by us last week, when we asserted that the operation of leaf-striking surpasses all others in interest and importance. That it is of the highest interest no one can deny; for what thing is there in the whole circle of gardening more surprising than the fact that a plant may be multiplied not only by its seeds, by its branches, and by its buds, but even by pieces of its leaves—by division of parts which the passer-by regards as mere objects of decoration, and scarcely of greater moment than the green shreds of linen and velvet which the flower-maker stamps into a wreath for a lady's bonnet. Can we possibly conceive anything better calculated to impress upon the mind the prodigious importance of these wonderful organs than a knowledge that they possess a vital energy of such force as to be able to produce a young plant? Physiologists teach us that leaves breathe and perspire; but common people can see nothing of that, and possibly disbelieve it. The microscope shows the leaf to be a most complicated and elaborate combination of tubes for carrying sap, and pores for ventilation, and twisted threads like windpipes, and cavities that act like stomachs, and long galleries of communication, a single square inch of which is more intricate than the skill of a thousand children of Dædalus could—we do not say contrive but—imagine. But there is not one man in ten thousand who possesses a microscope, or can use it if he has one; and statements like these carry no conviction to his mind; for he can see nothing more in a leaf than in a piece of paper or parchment. The regenerating power which a leaf possesses is one, however, palpable to the senses, and which all men can see; it therefore serves, better than any other demonstration, to impress upon the mind a conviction that it is an organ of the highest importance in the vegetable economy. For he must indeed be dull who can suppose that the office of propagation is intrusted by nature to any except parts of the most essential consequence. That consideration alone should put an end for ever to the ignorant practices of smothering or destroying foliage, for which bad gardeners are notorious.

With regard to its importance in a practical point of view, that, no doubt, remains to be proved; and it is mainly in the hope that attention will be skilfully directed to it that those observations have been made. It will, however, we trust, be considered, that if the operation of striking leaves can be reduced to tolerable certainty, it will give a new arm to gardening; and it is only reasonable to conclude that if several kinds of plants will readily submit to such treatment, others may be brought to obey the same power.

As has been already stated, the problem to be solved is how to nourish a leaf, removed from its parent, as effectually as if it were in its natural position. The difficulties connected with the question will perhaps be diminished, if we first ascertain what the means are by which certain leaves have been made to grow already. Mandirola tells us that he struck his lemon and orange leaves by keeping the soil in which they were inserted continually wet; that those of July, August, and November struck best, and the spring leaves worst. Mr. Knight, who made the leaves of the common peppermint grow, planted them in the early part of summer, in small pots, in heat, under glass. Bits of watercress leaves will strike root freely; but it is only such as float on the water. A curious instance of this is mentioned by Turpin. The larva, he says, of a species of phryganea, very common in ditches, uses its sharp jaws to cut in pieces the leaves of the watercress, in order to form the sheath in which it lives. But the stalk is the only part of which this little creature makes use; the leaflets it snips off; these, abandoned to their fate, float about until they shoot out a few rootlets; next follows from the centre of such roots a conical bud, and presently afterwards a young plant springs into existence. The common way of converting succulent leaves into plants is to place them on damp sand, under a bell-glass, or without one, according to the nature of the leaf. Mr. Neumann does not tell us how he struck bits of theophrasta leaves, and we therefore conclude that it was done under bell-glasses like other cuttings: he, however, states that the end of the stalk should always be a little buried in the earth, and that the leaves should be taken from the *middle of a branch;* the result is then more certain than if "radical" leaves are selected, by which we suppose him to mean leaves near the bottom of the branches.

It is clear from this that water is employed as a substitute for sap, in order to nourish the leaf, and that this is mainly relied upon. There are, however, some other points to which attention should be directed.

Of these, the first is to select leaves at the right season: if they are too young, they are not capable of feeding themselves when sundered from their parent; if too old, their vigour is impaired, and their vitality on the wane; this, too, diminishes the chances of success. Hence it was, no doubt, that Mandirola preferred the leaves of July and the following months—a period when the orange leaf in Italy is in its greatest vigour; and this, too, seems to explain the reason for Mr. Neumann's direction, that leaves should be taken from the middle of a branch.

A second precaution should doubtless be the application of more warmth than the leaves had been previously subject to. All the vital energies of plants are increased under the influence of heat, and in a case of this sort nothing should be neglected that would stimulate the flagging powers of life. Aided by warmth the leaves form their secretions faster, generate their cellular matter faster, and so form their callous sooner. Quickness of action is everything in such an operation as leaf-striking.

A third condition to insure will be perfect equability of moisture; the leaf must not be expected to feed by the end of its stalk exclusively, but food must be presented to its whole surface: not, however, too much, nor too little. If too much, the leaf will be unable to digest it, and will perish of repletion; if too little, the cells will collapse, their excitabilty will be impaired, and there is an end of the experiment. In this consists the great difficulty of the operation, for leaves have very different powers of taking in food and of digesting it; and nothing but experience can adjust exterior conditions to the peculiar organization of species.

The last point to which we need direct the attention of our readers is the necessity of exposing leaves to the free action of light. In natural conditions, a leaf does something more than feed—it breathes. The one act is as needful as the other. In the light, respiration goes on freely; in the dark, it is suspended, or at least is much impeded. But in sunlight, a leaf not only breathes, but loses water—a circumstance of no importance to it while upon its parent plant, because all loss is then made good from instant to instant, through the veins which pass out of the stem. Separated from its natural source of supply, the condition of the leaf is entirely altered; and it cannot be expected that the loss occasioned by evaporation should be as equally and instantaneously compensated. The only way of meeting this difficulty is by covering leaves with bell-glasses, whose edges are sunk in the damp sand, or earth, in which the leaf is to be struck. In this way, the leaf will always be in contact with moist air. Under a bell-glass, the perspiration of a leaf in sunlight is then so much diminished as to be of no importance, because, if the leaf is losing water, it is also absorbing it, and this as copiously as its necessities demand. It may therefore be exposed to the conditions favorable to its breathing, without danger of injury.

We are not, however, prepared to state whether thin leaves will really bear any amount of sunlight under the circumstances just described: that is a matter for inquiry; and we now commend it and all other questions connected with this operation to the ingenuity and skill of those whose knowledge of plants enables them to grapple with difficulties. We may be sure of this, that no one can institute a series of experiments into the subject of leaf-striking without gaining very valuable physiological information, whether he succeeds in the attempt or not.

I have been in the habit for the last three years of raising Camellia stocks from leaves, and I consider the plan an excellent one. The Camellia pæoniflora being the strongest growing sort with which I am acquainted, is the one I select for the purpose. In March, with a sharp knife, I cut off as many leaves close to the branch as I want, taking, of course, the buds off with them. The leaves are potted immediately in 48-sized pots, in peat and sand, and are placed about one-third their depth into the soil, and the pots are then

plunged into a tan-bed where no fire-heat is employed; they are covered with a hand-glass, kept moderately moist, and shaded when necessary. These leaves strike root, grow vigorously, and in two seasons make good stocks for grafting on. This mode of raising Camellia stocks is very convenient, for it is often easier to procure leaves than grafts, and the plan answers well when leaves are sent from a distance. In April, 1843, a blossom of a new double Camellia was sent to me; it had travelled upwards of 300 miles, and was so dry that I could not discover its color; there were, however, two or three leaves attached to it, one of which was treated as above, and I have now from it a very strong plant, 5 feet 6 inches in height, producing nine flower-buds ready to expand. The plant has been stopped twice in order to cause it to throw out branches, which are now 11 in number; the circumference of the stem is 1¼ inch at the bottom. I likewise raise orange stocks in a similar manner: the leaves are cut off in August, and are potted but not covered with hand-glasses. The stocks which I use for orange grafting are citrons, which being strong growers, make excellent plants by the following summer. The citrons, I imagine, may however be grown much quicker by putting in the leaves in February instead of in August. I have no doubt that the plants will be sufficiently strong to be grafted by the end of July or early in August.—*J. Markham, The Gardens, Hewell.*

That we did not over-estimate the interest to be taken in the question of propagating plants by their leaves is evident from the letters that have reached us on the subject. We select a few only from the correspondence before us, for the sake of the facts they adduce with reference to this curious operation.

That success is attainable, even in the present state of our information, to a greater extent than is usually supposed, is quite certain. For example:—A more unpromising plant than the Fuchsia could hardly be selected for experiment, and yet it proves to be one of those most willing to multiply itself by its leaves. We have the following fact from an intelligent correspondent, Mr. Reid, of Noblethorpe:—

"Last spring I put in a few cuttings of Fuchsias under a bell-glass; on taking them up for potting, I found amongst the sand two leaves that had dropped from the cuttings, and got imbedded amongst the sand about half their length, caused by occasionally taking off the glass to water the cuttings: to the petiole of each leaf was attached several fine fibres, nearly half an inch long. I carefully replaced them in the sand, and put the glass over them, and in a few weeks they both produced shoots, and are now good strong plants: the variety was Money-pennyii, a particular thin-leaved sort."

We do not, however, include among instances of unexpected success Mr. Markham's interesting account of his Camellia propagation because that is, as Professor Henslow has pointed out in another column, analogous to

striking from eyes, which is not at present under consideration. It will be better for the present to confine attention to instances of failure.

"F. H. S." states that the native gardeners in India are familiar with the operation of propagating plants from their leaves; and having frequently witnessed their success, he was induced to make the experiment on the leaf of an orange-tree. He cut off the leaf-stalk close to the leaf, which was inserted about 1-5th of its length into the mould; it struck root as readily as any cutting could have done; at the expiration of a twelvemonth he shifted it, when the pot was found filled with healthy fibrous roots. The main stem was as thick as a crow-quill, but there was no appearance of the formation of buds. At the expiration of above three years and a half, matters continued much in the same state, except that latterly a diseased spot appeared on the upper part of the leaf; this he cut off, and the remainder continued healthy; the stem had enlarged to the thickness of a swan's quill; the pot was filled with roots, *but still there was no appearance of the formation of buds*; and, despairing of success, he threw away the plants some months ago.

Mr. Paul, of Cheshunt, states that he has found some kinds of rose-leaves root more freely than even cuttings, but that they have invariably refused to form buds.

Another letter, signed "J. H.," repeats the same complaint. The writer finds no difficulty in persuading leaves to root, but he cannot succeed in forcing them to form a stem. We quote his statement at length:—

"Among other leaves, I have tried, in rather an extensive way, those of roses, especially the various kinds of perpetuals, bourbons, teas, lawranceanas, and their hybrids, and I find both leaves and leaflets, separated at any part of their stalk, to strike root even more freely than cuttings, when placed in *Shirley* sand, covered with bell-glasses, and plunged in a moderate bottom-heat. A single leaflet would emit one root about an inch in length in about fourteen days; a cutting of the young wood, made in the usual way, several roots the same length, in about three weeks; and a whole leaf, or pair of leaflets, cut through the main stalk, in from eighteen to twenty-one days, and sometimes would take longer, but the last would be more uncertain than either of the others. The whole leaves seldom lived long, their leaflets generally dropping on any change of temperature, and the roots decaying immediately afterwards; but the pairs of leaflets and single leaflets I have been able to inure to the open ground and keep alive for a whole year, by covering them during frost with a hand-glass; but with all the nursing and care I could bestow *I never could induce any of them to form a single bud*. In the hybrid perpetuals, that part of the stalk which was attached to the leaflet became round like a small stem, forming an irregular bulb at the lower end, as *large as the point of one's little finger*; but it never gave any indication of shooting, *although the leaflets enlarged to double their natural size*. In the summer of 1843, I cut a strong shoot of the Paul Joseph Rose; had every bud that

was fit, inserted in stocks, and after making a cutting of the soft part at the summit, inserted as cuttings the five leaflets taken from each bud, thirty-five in the whole, as an experiment. This was attended with the following result :—The buds nearly all took, and have made good heads ; the summit made a good plant, and flowered the following spring ; the greater part of the leaflets rooted, but never made buds or plants. I tried a shoot of cloth of gold noisette, in October of the same year, and with respect to buds, soft cuttings, and leaflets, met with just the same success. I should have continued my experiments still further, but I one day observed a plant of rosa devoniensis, which had been struck from a cutting, with one bud only, and that had gone blind. The leaf had preternaturally enlarged ; the leaf-stalk had changed from a deciduous to a permanent organ, and had become a branch, which was bulbing out at the confluence of the roots. I thought I would wait and see what this would do before I troubled myself any more with leaf-cuttings. Instantly commencing a liberal treatment, I shifted it into a larger pot, and took every pains with it ; but it never would make a bud, and in three or four months it died a natural death. This put me in mind of what gardeners call blind cabbage plants, and I made up my mind to have nothing more to do with leaf-cuttings (except for bulbs, herbaceous plants, and tuberous-rooted plants) until I could make a blind cabbage plant sprout. The art of doing this I have not yet discovered. When Statice arborea was a scarce plant, I struck several leaves by layering the mid-rib of the leaf, but with no better success. They formed roots and a tuberous appendage, but I kept them until I was tired before they showed any signs of buds. I cut through the mid-rib at about the centre, then passed the knife on each side sloping upwards, about half through the leaf ; thus forming a tongue, which I bent down into a small pot full of light mould. These were kept in a moderate heat, and uniform moisture, and in about a month they rooted, and were taken off, but with the ill success already mentioned."

Whoever the writer of this letter may be, we must congratulate him upon his good sense and skilful way of recording his observations, which are full of useful suggestions. Just now we must confine ourselves to the matter in hand.

That some leaf-cuttings, after having made roots freely, refuse—either wholly, or for sometime—to form buds, is well known. Clianthus puniceus belongs to the first class, and gloxinias to the last ; but gloxinias sprout freely enough with a smart bottom-heat, and when bright days follow the winter, during which they lay dormant. We suspect that all such cases may be forced into bud-making by the judicious application of sufficient stimulus. What "J. H.'s" dormant leaves wanted was plenty of bottom-heat, and the utmost quantity of light to which they could possibly be exposed. We should have placed them close to the glass of a propagating house, one-half of them under and the other half without a bell-glass, and have given them a bottom-

heat of from 70° to 80° for Statice arborea, or from 60° to 70° for roses. We should have exchanged Shirley sand for coarse peat and loam, and have watered them with weak manure water. By this means we should have exposed them to the most favorable circumstances that could be brought to act upon them, and we should certainly anticipate a successful issue to the experiment: it is, however, but an experiment; for, as we have already stated, this curious operation has excited little attention up to the present time, and a good many failures may be expected before the high road to success shall be macadamised.

What the unwilling roses and statice, and orange-tree wanted, was not vital force, for that they seem to have possessed in abundance. It was something on which to exercise their vital power that they stood in need of. That something was, in all probability, organizable matter; and organizable matter can only be generated by plants under the influence of bright sunlight. Darkness, or obscurity, are fatal to its production. In order to enable them to form such organizable matter with the utmost rapidity, an elevated temperature would probably be found of important assistance. We are not sure that we should not even lay bare the upper surface of the callous formed at the base of the leaf-cuttings keeping up a moist atmosphere around it. For it is in that callous that lie concealed those invisible germs which are eventually to arrange themselves in the form of a bud.

Of this at least we are sure, that men like "J. H.," bearing in mind these recommendations, will easily devise some means of gaining their end. That the callous formed by a leaf-cutting *must* eventually form a leaf-bud, under the proper circumstances, is as certain as that a live egg must hatch if the bird will but sit upon it long enough.

It would be worth trying the experiment too upon blind cabbage plants; not for the value of such things, certainly, but for the sake of settling a curious physiological question. If such plants can only be kept alive, there is no doubt that they will bud in the long-run.

The example referred of raising camellia stocks from leaves ought rather to be called the striking of buds. I am quite aware that germs are often developed from certain succulent leaves, and that they are capable of becoming perfect plants; but surely this is a physiological fact of a different description from the one referred to. The example with which I am most familiar is in gloxinia; but here also I observe the gardener always cuts off a portion from the surface of the stem, where there is, doubtless, a latent bud. The use of the leaf, in these cases, appears to be much the same as that of a cotyledon to the plumule--to supply the bud with nutriment, until it shall have protruded its roots. The leaf may further act in continually absorbing moisture, and forming fresh proper juice, much as those cotyledons, which rise above ground and become green.—*J. S. Henslow.*

This interesting subject appears to have been studied more on the continent than with us, particularly in Germany; and as we are beginning experiments, it would save time and trouble if we were in possession of the facts already ascertained in that country. Would it not, therefore, be desirable to solicit such information from correspondents at Berlin, Vienna, and Munich? The experiments commenced by Mr. Lucas, in the Botanic Garden, Munich, in 1839, must have furnished some useful data, and at Vienna matters have been accomplished with which we are yet puzzled. Lindley's "Theory of Horticulture" was lately translated there into German, and the translator—a scientific gentleman—added some useful notes of his own to many of the paragraphs (vol. iii. p. 398). Under par. 78, which refers to this subject, he writes: "The fine leaflets of a pinnated rose-leaf yield, under proper cultivation, fine little plants." Now, with this "proper culture" we are not yet acquainted, for from these fine leaflets on a common petiole we have not yet been able to form one plant, as far as I am aware. From experiments which I have made, I conclude that almost all leaves that have sufficient substance in them to allow of their being separated from the parent plant, without withering, will form callosities on their petioles, under the ordinary treatment of tender cuttings. But the degrees of excitability in different plants is such that the callosity of some leaves will furnish buds in a week or two, while others require months to do this. Others again take years before they form buds. I have kept camellia leaves, having large callosities, during four years, without their forming buds, and I have read of leaves which did not produce buds till the tenth and even twelfth year. Orange-leaves with me took from twelve to eighteen months, and some even longer, before they formed buds. I have ascertained that old leaves will form buds much sooner than young ones, but young leaves will form a callosity in less time than old leaves. Hence, the latter, if they are healthy, are best in cases that require a long time to make buds; the petioles of old leaves, like all soft parts of a tree, are more charged with the organized matter, which furnishes buds, than those of young leaves, and hence their power of sooner forming buds. The dean of Manchester, in the "Gardeners' Magazine," proposed a very curious experiment to be tried by gardeners, a few years since, which might easily be tested. He inferred that if the callosities formed by two allied plants could be made to mix with each other when being formed, that a bud from the united mass would partake of the habits of the two plants which formed the callosity. As this is a curious problem in vegetable physiology, and as there is nothing in science to oppose it, it is well worth trying.—*D. Beaton.* [We *particularly* recommend this experiment.]

ELECTRO-CULTURE OF CROPS.

By J. TOWERS, *Member of the Royal Agricultural Society of England, and London Horticultural Society, Professor of Agricultural Chemistry.*

The late inestimable article on Electro-Culture from the pen of Mr. William Sturgeon, which appeared in No. XII., New Series, of this Journal, claims the most serious attention. Far from desiring to supersede him in his attempt to accredit the cause he with so much skill and zeal undertook, it is my object to add force to what he has advanced. I therefore shall take the liberty to pass in cursory review the leading points of his article, and by appealing to the authority of Dr. Michael Faraday, of the Royal Institution, endeavour to elucidate the electric theory in general, so far as it may be possible, to induce the agricultural reader to give credence to the *reality* of that agent which abounds in every particle of matter throughout nature.

The late awful storms, and the tremendous manifestations of *that power* which all of us have recently witnessed, must strike the mind with assurance of the great fact, that electricity abounds in the air; and, under certain conditions, renders the watery vapour, which constitutes clouds, highly electrical. During the tremendous heats which prevailed from May 20 to August 1—heat which was of a dry character, with considerable density of the atmosphere—there was occasional transitions, wherein the air became sultry, oppressive, and vaporous. The first of these changes occurred with the summer solstice, when electric clouds formed, and some rain followed. Previous to this period, though the thermometer rose far above 80°, there had been no appearance of thunder clouds, or of evening lightning. The north or easterly winds had generally predominated; but with the 4th of July, and change of wind to S. and W., occurred the second sultry transition; and then, as too often has been the case of late years, on the 5th and 6th of July the land was visited by awful thunder, which introduced the usual rain of the season. These thunder storms are almost always succeeded by cool temperature, and so it happened in the present year. Again, the fine hot weather returned, and again the air became highly electrical and oppressive, followed on the 1st, 2nd, 3rd, and 5th of August by those fearful storms of thunder and hail, which appear to have visited every country of the kingdom.

We have thus proofs, ample and conclusive, that, by *solar influence* acting specifically upon the ground, the atmosphere becomes repleto with that extraordinary power which we term *electricity*. Having thus generalized, I come, without further preface, to the consideration of Mr. Sturgeon's Essay, which, as the writer assures us, was "undertaken for the sole purpose of stimulating farmers and other cultivators of the soil to pursue their inquiries in this important branch of research."

Passing by the greater part of the two first sections, pp. 263-265, the latter of which recites several instructive experiments of philosophers at different periods, referring to the influence of *atmospheric electricity on vegetation*; but at the top of page 267, we meet the name of Mr. Pine of Maidstone, which recalls to recollection a paper that appeared some years since, addressed to the Editor of the New London Mechanics' Register, signed T. P. I copied it entire for my Domestic Gardener's Manual, 2nd edit. p. 311, believing that, according to the then existing state of science, it embodied nearly all that was understood on "*the Relation between electricity and Vegetation.*" I now extract the most important passages verbatim.

The leading principles contained are,—that, vegetation is continually extracting electric effluvium from the atmosphere, which is constantly, though in degrees materially differing, in a state of positive electricity; that the structure of vegetables, and their juices, are adapted to act with the greatest efficacy in imbibing the effluvium, and that it is highly probable they are indebted to its influence for their vitality. Vegetables abound in pointed terminations, communicating with juices passing through capillary tubes, and possessing strong conducting virtues. The inference is strongly confirmed by applying *vegetable points* to the extension or prime conductor of an electrical machine. For, though it be only the juices of vegetables which possess conducting virtues, this circumstance concentrates the action of electricity upon them; and its grasses, leaves, and other sharp and pointed extremities will be found to act with a peculiar activity in drawing off the effluvium. Few facts, indeed, are regarded as more fully established than that metallic points are the most efficacious instruments in abstracting electricity. This conclusion can only be accounted for from the circumstance, that the attention of philosophers seems not to have been directed to the action of living points; for, on applying a blade of fresh grass and a metallic point, either alternately or in conjunction, to the electrized conductor, it will appear that the grass acts at a greater distance with more vigor than, and in preference to, the metal. The leaves of trees, and even their fine ramifications terminating in buds, and in general all the living pointed extremities, and the sharp and serrated edges of vegetation, will be found to possess the same energetic conducting qualities in proportion to their vigor, and the acuteness of their termination. Even a thorn or a thistle will vie with, if not excel, the sharpest needle in this property; and it may be observed that they are far better fitted to act upon the electricity of the atmosphere, as the deposition of moisture consequent to the withdrawing of the effluvium, which holds it in a state of vapour, so far from diminishing their conducting virtue, as in the case of metals is the very principle of their nutrition; so that there is reason to conclude, that the acting of every point furnishes it at once with the means of its vitality, and its growth and maturation. A few blades of grass held towards the nob of a charged jar, the circuit being completed by the human body, will silently, but quickly, effect its discharge, without sensibly affecting the human frame. In short, every experiment upon the electric properties of the points and edges of vegetation, evinces their peculiar adaptation for imbibing electrical effluvium beyond that of any other known bodies.

Mr. Sturgeon's 4th section is devoted to the consideration of *atmospheric electricity* (pp. 275-281); and to that the reader is referred in order to obtain conviction, upon very high authorities, that the air abounds with the subtile power so called, in a condition whereby it can be communicated to the earth through the media of metallic wires. He cites the experiments of M. Monnier in 1752; of L'Abbé Mezeas in 1753, and particularly those

of the Father Beccaria in 1756-7, who says—"On the latter end of March 1756, I climbed the high and steep mountain of St. Michael, and there I stretched and insulated several iron wires; one in the direction of the meridian of the monastery to the ruins of the *Sepulchre,* which was 1600 feet long." Other and very numerous trials were made, which are mentioned in *Beccaria's* work on "Atmospheric Electricity;" and the inference drawn from the whole is stated in the following words:—"Ever since I began to observe atmospheric electricity during *serene* weather, the whole series of my observations has confirmed it to me, that this electricity is constantly of the *excessive* or positive kind."

We shall see hereafter the opinion on the positive and negative states and charges, recently formed by Professor Faraday; it will now suffice to show, that the atmosphere is generally in a state to warrant the hypothesis and experiments of Dr. Forster of Findrassie.

Mr. Sturgeon adduces the authority of Cavallo, the Rev. Abraham Bennet of Wirkworth, and of Mr. Reid of Knightsbridge, from whom a striking quotation is given at p. 298.

Then follow the modern experiments of Mr. Crosse, near Taunton; of MM. Biot and Gay Lussac, in 1804; a variety of interesting experiments by Mr. Sturgeon himself; and finally, those conducted at Sandwich in 1840 by Mr. Weeks, the results being equally grand and appalling.

Mr. Sturgeon winds up his train of evidence thus—

I have been particularly solicitous in bringing these facts to the notice of electro-cultural farmers, in order to convince them that the apparatus about to be described is admirably adapted for conveying to the land immense quantities of the electric fluid when disturbed by lightning, or even by the presence of highly charged clouds; and that at other times, when no cloud is present, the apparatus is capable of supplying the soil with a greater quantity than it could otherwise receive from the contiguous dry air.

Having advanced proof sufficient to sustain the leading principle that the air contains electricity, which may be rendered available to man by the employment of adequate machinery, we will go back to section 3 of Mr. Sturgeon's Essay, which treats of "The *Elementary Principles of Electricity* necessary to be understood by the Electro-culturist." And here the author enters somewhat at large upon the great principle of induction. It should appear that every substance in nature, and every *atom or particle* of that substance, is, according to its capacity, combined with, held together, or perhaps, in the case of gases or elastic uniform bodies, surrounded in all its particles by this elementary power. By referring to Dr. Faraday's "*New Researches,*" a striking view of electric induction may be obtained; but previously we find, according to Mr. Sturgeon, (p. 271)—

Whatever may be the quantity due to any individual object under ordinary circumstances it becomes exquisitely susceptible of disturbance when the circumstances vary, and whether

these be of natural or of artificial occurrence. A disturbance of the electric fluid in any body may be accomplished either by abstractions, additions, or by merely forcing a part of it to some particular side of the body operated on. In the first condition the body would be *electro-negative*, in the second *electro-positive*, and in the third *electro-polar*.

Without insisting upon, or indeed arguing for, the existence of two distinct electricities, I cannot entirely assent to this definition. If there be not *two powers*, there are at least two equal states or conditions of *one* great agent, the balance of which may be disturbed, and again restored to perfect equilibrium. Whatever may be said or thought, or apparently proved by experiments, of the *plus* and *minus* conditions of disturbed electricity—evidence which ought to be conclusive exists (notwithstanding admitted difficulties) to prove, even to demonstration, that two forces always are present, setting in one toward the other, like two darts that meet at a centre, or to speak more correctly, that pass as from a centre outwards in opposite directions. To exemplify this by a familiar experiment which is open to any one :—It consists in sending a powerful shock from a charged Leyden jar through a card, when it may be distinctly perceived that the puncture made by the charge exhibits the *two* sides of the card forced *outwards*, just as if the puncture had been made by two points *at* and *through* the tissue of the card *from* its centre.

Dr. Faraday has this remarkable passage at p. 518, 8vo. edition, series 13 of the *New Researches*,—

No. 1627.—It is a most important part of the character of the current, and essentially connected with its very nature, that it is always the same. The two forces are every where in it. There is never one current of force, or one fluid only. Any one part of the current may, as respects the presence of the two forces there, be considered as precisely the same with any other part; and the numerous experiments which imply their possible separation, as well as the theoretical expressions which, being used daily, assume it, are, I think, in contradiction with facts, (511, &c.) It appears to me to be as impossible to assume a current of negative force alone, or the two at once, with any predominance of one over the other as it is to give an absolute charge to matter.—(Refers to 516, 1169, 1177.)

There is another experiment which I have performed, perhaps fifty times, with a cylinder machine of greater power than is usually met with in private hands. The results were invariable, and at the time were to me conclusive of the theory of *two electricities* professing different characters, but attractive of, and perfectly neutralizing each other. Two jars of equal capacity were charged at the same moment by the same revolutions of the machine, by connecting the ball of the one with the ball fixed at the remote end of the prime conductor—and the other with the ball of the cushion conductor—(for the machine was furnished with both—the one producing *positive*, the other at the back of the rubber, *negative* power.) The quadrant electrometer and pith-ball guage, proved the charge of each jar to be real, although the advocates of the Franklinean hypothesis presume that the jar at the

rubber end was emptied or discharged, and brought to the minus condition. Removing the jars, and placing both on an insulating stand, a pith-ball suspended by a dry thread of silk, was made to approach the knob of *each* jar—it was at first attracted equally by one as by the other, and then immediately repelled, revolving round the knob as in an orbit several inches distant from it. If the ball employed for one jar, so revolving, were made to approach the other, it was again attracted and subsequently repelled. Again, if the jars were brought so near to each other, as to permit a neutral suspended ball to reach the two knobs, and be placed within the sphere of attraction of either jar, (no matter which,) it was drawn to the knob, then repelled from it, and instantly attracted by the knob of the other; thus passing in successive alternations from one to the other, till it gradually neutralized the condition of each. Finally, a strip of tin-foil was placed under the two jars; thus they were connected together by their outside tin-foil coatings: a jointed discharger, with double knobs, and insulating glass handle, was then made to approach each knob of the jars; and when at striking distance, the circuit being thus completed, explosion took place, and the electrical tension vanished—or, to employ conventional language, the two jars were discharged between knob and knob, as completely as any single charged jar would have been by forming the circuit between its coating and knob.

It is evident, from the undeniable facts thus appealed to, that each Leyden jar was in an electrized condition, both producing similar phenomena, but in alternate order; the one attracting what the other repelled: the phenomena of both were sensible and visible; it would be futile to say that the one was empty or *minus*, the other charged or *plus*. If both were electrized—or charged—how had they become electrized, and what the charge? The questions are the more pertinent, inasmuch as precisely corresponding phenomena are induced, when one of the jars receives a charge by its knob, which conducts to the *inside* coating, while the other shall be charged by presenting its *outside* tin coating to the *same* conductor, the jar being first placed upon an insulating stool, the knob being connected with the earth by means of a chain or wire. If *one* conductor, therefore, can produce *two* different conditions of charge, by merely operating upon the *inside* coating of one jar, and upon the *outside* coating of the other, can we by possibility suppose that electricity is a *single power*? Dr. Faraday says, at No. 1176:—

Evolution by friction gives both powers in equal proportion: So does evolution by chemical action, notwithstanding the great diversity of bodies which may be employed, and the enormous quantity of electricity which can in this manner be evolved. The more promising cases of change of state, whether by evaporation, friction, or the reverse processes, still give both forms of power in *equal* proportions; and the splitting of mica and other crystals, the breaking of sulphur, &c., are subject to the same law of limitation.

(1177.) As far as experiment has proceeded, it appears therefore impossible either to evolve or make disappear one electric force without equal and corresponding change in the other. It is also equally impossible, experimentally, to charge a portion of matter with one electric

force independently of the other. Charge always implies Induction, for it can in no instance be effected without; and also the presence of the *two* forms of power, equally at the moment of the development, and afterwards. There is no *absolute* charge of matter with one fluid; no latency of a *single* electricity. This, though a negative result, is an exceedingly important one, being probably the consequence of a natural impossibility, which will become clear to us when we understand the true condition and theory of the electric power.

(1178.) The preceding considerations already point to the following conclusions: bodies cannot be charged absolutely, but only relatively, and by a principle which is the same with that of induction. All *charge* is sustained by induction. All phenomena of *intensity* include the principle of induction. All *excitation* is dependent on, or directly related to induction. All *currents* involve previous intensity, and therefore previous induction. INDUCTION appears to be the essential function both in the first development and the consequent phenomena of electricity.

With these leading principles, as now advocated by our great philosopher, we may elucidate in a few words the action and effects of simple induction. Suspend from a rod of dry wood two small brass, or gilt pith-balls, by threads of silk of equal length. Excite by strong friction of a dry and white silk handkerchief, a glass tube of an inch diameter, solid, and rounded off at one end. Let the excited tube be brought opposite to one of the balls on the same line with the other which is more remote: the positive electricity of the tube will *induce* disturbance, attract the *negative* electricity of the first ball, and bring it to the side next in face of it, while at the same moment the opposite side of the ball, that most remote from the tube, will be brought into the *positive* condition; this first ball will also act upon the other ball, and induce similar conditions; so that if a third, and much smaller pith-ball, be held by a thread exactly between the two others, it will--provided the distance be not too great—travel between them so long as the electric excitation is kept up. Balls, or any other forms of matter, thus treated, become *polar*, one to the other, and the action by which they are so polarized, is termed *induction*, because two opposite states, each attractive of the other, have been *induced* by the exciting electric.

I now return to Mr. Sturgeon's essay, with a view to introduce a striking circumstance, worthy of rigid inquiry and observation. He says—

The various objects which constitute the vegetable clothing of the land are never in precisely the same electric condition, being continually *positive* and *negative* with regard to each other. An oak and an ash tree, for instance, though both in their ordinary or normal electric states, are not endowed with the same degree of electric force, one being positive to the other, and consequently, the latter *negative* to the former.

This mention of the *oak and the ash*, and their opposite electric states, (which latter implies of necessity a *polar* condition of both, induced by a specific condition of the atmosphere,) involve the question of *how far* these *trees*, at the period when they develope their foliage, may be considered indexes of the succeeding summer. Many persons have taken notes of the spring state of the trees, and certain provincial papers have given publicity to such observations.

It has been thus stated, that if the leaves of the oak appear much in advance of the ash leaves, the succeeding summer will be warm and dry. On the contrary, tho earlier development of the ash foliage may be taken as a prognostic of a moist summer, while a simultaneons leafing affords promise of a changeable state of the weather.

In 1844, the oaks had the start, the spring was fine, the summer early, and generally hot; crops were carried early; but so severe was the drought from the first week of April, that little or no hay was made, and green fodder failed. In the present year, March and April were wet and cold, so that fears were entertained of a bad early summer; still, in that state of weather, the *oaks* were *more* than *usually early*—in many instances above four weeks in advance of the ash trees. On the 20th of May fine weather was confirmed, with great and advancing heat, which lasted, with few intermissions, till the storms of July 6th and August 1st. So severe was the drought in Berkshire, that the rains which fell during nine weeks had not really moistened the ground to the depth of five inches. On the whole, the average temperature was four or five degrees in excess to the 10th of August. It may then be said with truth, that since the commencement of dry weather in May, about the period when tho ash trees had fairly put on their green clothing, the summer has been generally dry and unwontedly hot.

Could it be substantiated upon decisive evidence that the comparative spring position of the two trees furnishes a trust-worthy indication of the future summer, we might satisfy ourselves that tho electro-polar condition of either tree was dependent upon a specific electric state of the atmosphere; and hence be enabled, philosophically, to account for phenomena which it were superstitious folly to refer to blind prognostic. The subject is undoubtedly worthy of attention on the part of those who take meteorological observations, and note them down.

There remains much choice matter in the whole of Mr. Sturgeon's third section, which there is not now space to notice, and I must pass on to section 5, which treats *practically* of electro-culture.

Before the writer alludes to the experiments of Dr. Forster, he says, p. 284—

> There is every probability before us, and not even a suspicion left to the contrary, that the grand stimulus of vegetable life is the electric fluid, under which impression we are forced to acknowledge that agent to be as essential to the welfare of plants as either rain or manure; for independently of a stimulating force, neither manure, rain, nor soil, could lend even the remotest aid in propagating vegetable structures.

These are opinions, which I have advocated for years, and in which I entirely coincide. Decomposition of manures is essential to growth; decomposition is a chemical process—and all chemical action is strictly electrical. I am happy to cite the authority of Dr. Faraday, as I find it in No. 1161 of his

New Researches, as it appears to me to add weight to the above theory, while it instructs the inquirer.

The science of electricity is in that state in which every part of it requires experimental investigation; not merely for the discovery of new effects, but what is just now of far more importance, the development of the means by which the old effects are produced, and the consequent more accurate determination of the first principles of action of tha most extraordinary and universal power in nature:—and to those philosophers who pursne the inquiry zealously, yet cautiously, combining experiment with analogy, suspicious of their preconceived notions, paying more respect to a fact than a theory, not too hasty to generalize; and, above all things, willing at every step to cross-examine their own opinions, both by reason and experiment, no branch of knowledge can afford so fine and ready a field for discovery as this. Such is most abundantly shown to be the case by the progress which electricity has made in the last thirty years. Chemistry and magnetism have successively acknowledged its ruling influence; and it is probable that every effect depending upon the powers of inorganic matter, and perhaps most of those related to vegetable and animal life, will ultimately be found subordinate to it—(p. 360.)

Dr. Forster's mechanism with the view to distribute electricity throughout an oblong surface of land, is described by Mr. Sturgeon at page 283, where two wood-cuts are given—fig. 4, to exhibit the radiation of electricity when passing through metallic wires—and fig. 5 the *position* of the underground wires adopted at Findrassie.

As it may be satisfactory to the reader to become acquainted with some particulars connected with these experiments, I take the liberty to present an extract from a letter written to me by Dr. Forster, subsequent to the communications which were made public in 1844. His words are—

The buried wires should be as straight as they may conveniently be placed; it is not so important, in my opinion, that they should be magnetically due north and south, although mine were, and are; but the suspended wire *must* be so; therefore the two buried wires on the east and west sides of it, should necessarily (if not parallel to the suspended wire or wires) be of eqnal lengths.

The rule for the height of the suspended wire is 8 to 10 feet above the utmost probable height of the plants, where one wire is employed; and if more, each three feet above the one beneath it. My wire of a small plot, will not, on some occasions, just before sunrise, deflect the needle 10 degrees—in an hour 90 degrees; this I often observe in clear weather. In cloudy mornings, if cool, it will be 10 or 12 o'clock before the needle is deflected 90 degrees; many other facts I hava noted tending to this opinion.

Connected with the length of the poles, Mr. Sturgeon, at p. 284, mentions the loss of color in a plot of barley over which the suspended wire was raised by poles 4 feet high: this loss of verdure was evidently owing to the *attraction exerted by the pointed terminations of the barley*—they had superseded the wire, and put it out of office: Dr. Forstor (for the experiment was *his*), therefore, had "fixed to each pole a piece of dry pine, eight feet high, and suspended two wires to them, one at that elevation, and another a foot lower down, and was pleased to find that, after some time, this plot *partially resumed its former dark-green color*, which it had previously lost."

Mr. Sturgeon proceeds to deseribe the several experimental trials he undertook, and gives drawings of the modifications of the wire apparatus employed by him; to these the reader is referred—with the account of the results—at pp. 284—8, and section 6, 288 to 294. Section 7 consists of concluding *remarks*, with *Practical Rules for future Experiments.*

It should appear that Dr. Forster's arrangement of the strained wire, in the direction of the magnetic meridian, as indicated by tho compass needle, was adopted in consequence of a theory which is ascribed to M. Ampere, a French philosophor, who, in attempting to account for the earth's magnotism, supposed that there was a continuous flow of electric fluid round tho axis, from east to west.

Mr. Sturgcon questions the accuracy of the hypothesis, and the existence of any such currents. The magnetism of the earth itsolf—in its ordinary acceptation—as supposing the earth to be a magnet, is more than doubtful; for, as electricity itself must be referred to the *sun*, either as its *direct fountain*, or by its influence upon tho surface of the earth, as producing those disturbances of the *power* which we call electricity—so magnetism may depend altogether upon these disturbances, operating in a way, and by means, which as yet remain profound mysteries.

Faraday, at Series II, No. 191, has the following remarks on terrestrial currents :—

Though positive results have not yet been obtained by the action of the earth upon water and aqueous fluids, yet as the experiments are very limited in their extent, and as such fluids do yield the current by artificial magnets, (for transference of the current is proof that it may be produced,) the supposition that the earth produces these induced currents within itself, in consequence of its diurnal rotation, is still probable; and when it is considered that the moving masses extend for thousands of miles across the magnetic curves, cutting them in various directions within its mass as well as at the surface, it is possible the electricity may rise to a considerable intensity.

Dr. Forster, as we have seen, insists upon the necessity of placing the cross or stretched wire in tho line of the magnetic north—that is, at some degrees west of tho north pole, according to the existing variation of tho compass; but Mr. Sturgeon, seeing " no reason to believe that a continuous electric tide in the air sweeps the surface of tho land from east to west, nor any means, at our disposal, of confining electric influences within the limits of a marginal wire in the ground," says, that "there is no authority, from facts, for making choice of the magnetic meridian;" and, therefore, proposes several improved modifications, or arrangements, of *copper wires*, as being of superior conducting powers, and less liable to chemical action than iron." Ho also says that, as the prevailing winds are, in most parts of Britain, easterly in the spring, and wosterly during most part of the summer, ho would proposo to stretch a pair of wires from NE. to SW., and another pair above or beneath, crossing them at right angles. I refer the reader to the descriptions and plans at 295-6,

and shall confine what further remains to be said to the consideration of the manner in which atmospheric electricity may, upon philosophical principles, be presumed to affect the soil, and the roots of plants growing within it.

It has been shown that the air is an electric, while it remains dry and dense; consequently that it must, of necessity, act upon, and polarize, the moist vegetable tissues which are in a growing state. Mr. Forster's experiments with iron wires, stretched over poles of different heights, connected with others buried three inches deep in the soil, and enclosing areas of land, were found to fail, or at least to become inefficient, when tall-growing plants —as of wheat or barley—attained height enough to attract the electricity, which might, perhaps, have passed through the wires; and to have recovered verdure when the said wires were elevated several feet above their first position. That wires so arranged occasionally give forth sharp, pungent sparks, I have been assured by the report of men who were employed to put them up; and that the compass needle has been deflected when suspended over the pole wires, has been attested by Dr. Forster. Now, admitting the force of such evidences, we would inquire in what manner electricity, thus conveyed to the ground, can act upon it so as to stimulate the vegetable organism and promote the formation of sap by the more rapid decomposition and laboration of manure.

I believe, with Dr. Faraday, that they imbue every atom or ultimate particle of matter, and, when stimulated, polarize it, conferring upon the said particles a double power, which, in the curreut, moves in opposite directions with inconceivable activity, and communicates the same powers and movements to the particles of every conducting substance within the sphere of their influence. Thus, then, when wires are stretched above crops, and conducted down to a system of under-ground wires, arranged according to Mr. Sturgeon's newly proposed modifications, whatever electricity, with its *transverse* electro-magnetic radiations, may pervade the elevated wire, will act *throughout* its particles, and induce similar phenomena in every portion or branch of the system buried under-ground; and thence proceeding outwardly, will act upon the moist particles of manure and earth about and among the roots. This latter action is strictly electro-chemical, being precisely representative of that which a living plant, electrized by the atmosphere, exerts *individually* by its branching series of roots and rootlets, upon the decomposable substances adapted to its nutrition.

A good deal has already been said of induction and polarization; but in order to render the theory still more clear, I must, in justice to its advocate, appeal once more to the *New Researches*. Thus, at p. 362, No. 1165, the author says—

At present, I believe ordinary induction in all cases to be an action of *contiguous particles* consisting in a species of polarity, instead of being an action of either particles or masses at sensible distances; and if this be true, the distinction and establishment of such a truth must

be of the greatest consequence to our further progress in the investigation of the nature of electric forces. The linked condition of electrical induction with chemical decomposition; of voltaic excitement with chemical action; the transfer of the elements in an electrotype; the original cause of excitement in all cases; the nature and relation of conduction and insulation; of the direct and lateral or transverse action constituting electricity and magnetism; with many other things more or less incomprehensible at present, would all be affected by it, and receive a full explanation in their reduction under one general law.

Dr. Faraday has made other advances since he penned the foregoing in 1837, and more of the mysterious connexion of *light*, electricity, and magnetism has been laid open by experiment. I could earnestly wish that the pure solar beam were always made the subject of these investigations, for *it is the fountain* of all, and more likely to lead to the discovery of the *truth of nature* than the secondary light emanating from chemical combustion. However, discovery must, perhaps, proceed step by step, and we welcome its progress.

One more quotation must suffice to disclose the position of electric laws, as we find it in the opening paragraphs of the *Researches* of 1838, on the '*Nature* of the *Electric Force or Forces*,' the *electric current* had been viewed throughout as an *axis of power* having contrary force, exactly *equal in amount in contrary directions*, and the author thus embodies the principles of an *hypothesis* derived from experiment: it assumes—

That all *particles*, whether of insulating or conducting matter, are as wholes *conductors*.

That not being polar in their normal state, they can become so by the influence of neighbouring charged particles, the polar state being developed at the instant, exactly as in an insulated conducting *mass* consisting of many particles.

That the particles, when polarized, are in a forced state, and tend to return to their normal or natural condition.

That being as wholes conductors, they can readily be charged, either *bodily* or *polarly*.

That particles which, being contiguous, are also in the line of inductive action, can communicate or transfer their polar one to another *more* or *less* readily.

That those doing so less readily require the polar forces to be raised to a higher degree before this transference or communication takes place.

That the *ready* communication of forces between contiguous particles constitutes *conduction*, and the *difficult* communication *insulation;* conductors and insulators being bodies whose particles naturally possess the property of communicating their respective forces easily or with difficulty.

That ordinary induction is the effect resulting from the action of matter charged with exciting or free electricity upon insulating matter, tending to produce in it an equal amount of the contrary.

That it can do this only by polarizing the particles contiguous to it, which perform the same office to the next, and these again to those beyond; and that thus the action is propagated from the excited body to the next conducting mass, and there renders the contrary force evident in consequence of the effect of communication which supervenes in the conducting mass upon the polarization of the particles of that body.

With this statement of a most refined hypothesis, I come at last to the consideration of its applicability to electro-culture. It may so happen that

nature is all-sufficient to supply each individual plant with its appropriate share of atmospheric *power*, and if so, our machinery can be made of no real service. Still, as a question of philosophy, it would be equally edifying and delightful to prove that a stimulus in excess was at command; and, with that discovery, we might rest pretty nearly certain of the mode of action in all cases where a series of copper wires was found to act beneficially upon the plants growing in a small plot of ground.

By the propagation of excited particles *throughout that system*, we should act upon decomposable particles around and *beyond* it; for the electric power thus distributed would perform the roll of a voltaic apparatus upon the moistened manure combined with the earth, whether they were *organic* or *inorganic* in their nature.

Let experiment prove, beyond question or doubt, that the atmospheric electricity *may* be communicated to the soil, and then the cultivator can proceed, step by step, in hope, till at length, by the aid of chemical science, and the wise application of mechanical structure, something truly beneficial to agriculture may, in process of time, be ascertained and adopted.—*(From the Journal of Agriculture and Transactions of the Highland Society of Scotland, for October,* 1846.*)*

TRANSMISSION OF CONIFERÆ FROM THE HIMALAYAS.

By JAMES GRIOOR, *Norwich.*

One of the great features of Arboriculture in the present day consists in the introduction of many species of trees belonging to foreign countries. Of these the chief are comprised in the various kinds of Coniferæ from the Himalayas. Having now a resident collector there, I am enabled to communicate some further particulars relative to the transmission of seeds, which cannot fail to interest all those who have waste lands to plant, or who may have friends or relations in India, through whom a supply may be procured. With many, the policy is to keep such information to themselves; but as I am anxious to see the waste parts of England full of those splendid trees which adorn the mountains of India, no matter by whom such trees are supplied, I am induced to lay before the public all the particulars, so far as my short experience goes. My collector is at present stationed at Deyrah Dhoon, bounded on the east by the Ganges, and on the west by its mighty tributary, the Jumna. This place is in the principality of Serinagur, North Hindoostan. The Deodar forests appear on all the surrounding mountains, skirted, and in some instances the trees are intermingled, with those of the *Kyle*, which, from the seedlings in my nursery, I find to be the Pinus excelsa

of botanists. The rainy season peculiar to that country generally commences in July, and ends about the 20th of September, and the best time to gather the cones, when they are intended to be sent home, is during the earlier part of October. In 1844, when the rainy season was over ten days sooner than it was ever known to stop before, and when the intensity of the sun was unexampled, it was necessary to gather the cones (which were rather prematurely ripened in that instance) three weeks sooner than usual; but as a general rule the first three weeks in October may be considered the best time to collect them.

Great diversity of opinion exists as to the best mode of transmitting the seeds.* When very large quantities are to be sent, I should recommend the packages to be forwarded by a sailing vessel. The seeds should come in the cones, packed in boxes amongst any dry chaffy substance. Every cone should be coated over with resin, or any other similar substance, to fill up the interstices between the scales, and carefully and tightly tied, so as to prevent the possibility of their expanding during the voyage. They should then be wrapped separately in brown paper and tied again. When thus treated, the air is excluded from the seeds; but if this precaution should be omitted, the cones will be in pieces when they reach this country, *and not one in a hundred of the seeds will vegetate.* Calcutta is the sea-port for the Himalayan district, and my last consignment of cones which came by a merchantman from that port, was about five months on the way.

When the packages are small, the overland route, *via* Egypt, should be adopted; for by this mode seeds may be received in the course of two months from the time of their being gathered. The average length of passage from Calcutta to England, by the Oriental and Peninsular Steam Company's vessels, which carry Her Majesty's mails, is forty-eight days.

To Calcutta, packets should be sent by *banghy;* those not exceeding twelve inches by twelve inches, or such as do not exceed fifteen pounds

* On this point the following extract of a letter from Dr. Wm. Jameson, Supt. of the H. C. Botanic Garden, North Western Provinces, to the Secretary of the Agricultural and Horticultural Society of India, is well deserving of notice, as the opinion of a gentleman who has had more experience in the transmission of the Coniferous seeds of the Himaleya than perhaps any other resident in India. The letter was written in reference to a request that the seeds might be despatched *in their cones,* under the impression that if taken out of their cones they would fail to reach their destination in germinating condition.

"Neither you nor Mr. ——— seem to be aware that the *Cedrus deodara* (Deodar) cones fall to pieces when the seeds are ripe, rendering it impossible to transmit them in cone. This applies also to several of the other pines. To collect pine and other seeds, I have a large establishment dispersed on the hills between the Sutledge and Cali, and I expect daily to get large supplies. The pine seeds will however reach this [Saharunpore] with the cone. To the Court of Directors I send maunds of pine seeds in this state, and also supply an immense number of individuals, and I invariably find that, if the seeds are sent by the overland route, they germinate. I have now [October 30th 1846] received about a maund [80 pounds weight] of Deodar seeds this season, and they are, I am glad to say, in fine condition. I have ordered a couple of parcels to be made up and addressed, as directed."—*(Eds. Journal Agricultural and Horticultural Society of India.)*

weight, are received at the post office, and forwarded at the convenience of the authorities there, that is, when they have a sufficient quantity for a despatch. Some idea of the expense will be inferred, when I state that the last parcel I had, which weighed 2½ pounds, cost 1*l.* 15*s.* 6*d.*; but as it was paid to Calcutta, fifteen shillings more should be added in order to get at the entire cost. This is expeditious work, but expensive. In order to make the most of it therefore, the following instructions should be attended to:—Gather the cones in the last week of October, when many of them will be opening naturally with the heat of the sun: what are not open can be easily broken by pressure of the hand: select only plump, full seeds, detach them from the wings by rubbing, and then put them, along with the wings or chaff (which weighs nothing), into a wax-cloth bag. The chaff will keep the seeds from being bruised. In this way they will reach England in safety, and a great proportion of them will vegetate. In no instance should they be sent so as to reach this country later than the end of April. Upon the whole, I prefer the overland route for the Cedrus deodara and Pinus webbiana. The seeds of the *Kyle* or Pinus excelsa and the Hill Cypress (Cupressus torulosa) do well enough in a common canvass bag, enclosed in a box, and sent by any trading vessel. The former has a thick shell-like covering about the kernel, which no doubt accounts for its withstanding the influence of the weather; and the latter, though apparently without such protection, have grown remarkably well after a tedious voyage. The seeds of the P. excelsa, and C. torulosa should be steeped for two days before sowing in water, kept as warm as new milk: the Deodar, on the other hand, derives no benefit from this treatment.

To a very few it may appear superfluous, but I well know that for the sake of the many it is necessary to add how such packages should be addressed by any one living in India, who has the means of sending home pine seeds. Small packages, as I have said, will be taken charge of by the post-office authorities in the interior of the country: larger ones, weighing more than fifteen pounds, are forwarded by *pony, cooley,* or *cart,* travelling at the following rates:—Pony, six days per hundred miles; cooley, seven days per hundred miles; and cart, twelve days per hundred miles. The package should be fully addressed to the parties in England for whom they are intended, then forwarded, by either of the before-named conveyances, to some agent at Calcutta, together with an account of the value and contents of each, and instructions for them to forward the same *overland* to their London correspondents, who will duly receive, and communicate with the parties to whom they are addressed, as to when and where they shall be sent. The parties sending must pay or be answerable for the expenses payable at Calcutta, and the parties receiving must pay the expenses in London, viz. customs, clearing, &c.—*(From the Horticultural Magazine for October,* 1846.*)*

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CORRESPONDENCE AND SELECTIONS.

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Correspondence and Selections.

FURTHER CORRESPONDENCE RELATIVE TO THE VALUABLE PROPERTIES OF AMERICAN SUMACH, OR DIVIDIVI, (CÆSALPINIA CORIARIA) AND OF SICILIAN SUMACH, (RHUS CORIARIA). COMMUNICATED BY DR. WALLICH.

Extract of a letter from DR. ROYLE, *to* DR. WALLICH,—*dated East India House, London; 18th September*, 1845.

"You will, I fear, have thought me very inattentive respecting your Dividivi, the success of which has been so complete. But the fact is, I did not get a report upon it from those to whom I had sent it, as you will see by the enclosed from Messrs. Hackblock and Clarke, successors to Mr. Bruen, who was one of the largest Tanners in the vicinity of this huge capital. I have this day seen Mr. Hackblock, who informs me, that the Indian grown Dividivi is as good as the best American samples, if not better; but it is difficult to judge of, because, being without seeds, necessarily contained a larger per centage of tannin than if the seeds had been mixed with it. Mr. Bruen was one of the first in this country to use the Dividivi, but he found that it did not give a good color to leather; that if used on a large scale, the leather became by degrees of a reddish color and hard; though the smaller specimens had been soft and light colored. They do not use it much at present, though considerable quantities are imported; chiefly used for tanning leather for soles of shoes. But everything depends upon the price of bark and the supply of other things. When bark is dear, substitutes are employed and in demand. Mr. Bruen and Messrs. Hackblock and Co. also employed Myrobolans in considerable quantities; but the price was run up in India, as well as the freight, and it became too dear to employ as a substitute, and I believe they do not at present employ it. Whether Dividivi will answer to cultivate it as an article of commerce, I cannot say, as its price is only £10 or £12 per. ton; but there can be no doubt from Mr. Teil's letter, that it will be a valuable addition

to the tanning substances of India, and in that respect desirable to cultivate. If I learn anything more respecting it, I will let you know."

To Dr. Royle.

Dear Sir,—We are in receipt of your favor of 9th, with its enclosure, for which we feel much obliged. Our Mr. Clarke is out of town, who made the trial of your Dividivi, but will be back on Saturday; in the early part of the week, you shall have all particulars.

The writer will bring you a sample of Valonia, which, if it could be introduced into India, would be of great importance, its quality being so superior to Dividivi, and its value so much greater.

I am, &c.

Willow-wall, Grange Road, Bermandy; For self and partners,
12th September, 1845. (Signed) J. Hackblock.

To N. Wallich, Esq. M. D., &c. &c. &c., *Botanical Garden.*

Dear Sir,—I beg to return, with my best thanks, the accompanying letter from Professor Dr. Royle, with its enclosure from Mr. J. Hackblock, with the perusal of which, I have been kindly favored by you.

I am aware that Valonia is used for tanning purposes in England, but have never made use of any myself. I believe the article is altogether unknown to our Indian Tanners; and though I do not recollect that any importation of it has, as yet, taken place in this country, I observe from the London Price Currents of Nesbitt's the brokers, for September 1845, that the importation from Smyrna (whence I believe it is chiefly brought) amounted in that month to 1139 tons, and that 520 tons were either actually sold, or bespoke, in the same month of September. Its price is quoted so high as £15; and £15-10*s*. per ton, while the Oak bark is quoted at not more that £6-4*s*. the ton: not more than 118 tons of the latter is stated to have been sold in the same month, and the stock on hand to have been only 357 tons. The sale again of Oak bark is stated to have remained *dull*, as in former months. Dividivi continued in limited request, and no importations or sales of it had taken place in September. These facts, if correctly quoted by the brokers,

and I can see no reason to doubt their accuracy, go to give the Valonia a preference with the Tanners in England, over not only Dividivi, but even of Oak bark itself, though the latter has, heretofore, held a place in England above all other substances for common tanning purposes. To establish the superiority, in this respect, of Valonia over Oak bark, not only do we find it in greater demand, but even to realize a price greatly exceeding twice that of the latter. What the circumstances are, which give it this superiority, are wholly unknown to me, but I can, if you should wish, give it a trial, upon receiving from you, any quantity of the article you can spare me for that purpose.

Not having had a sufficient quantity of your own grown Dividivi, or Sumach, to try upon a large skin or hide, I am unable to judge of the fact stated by Mr. Bruen, and alluded to in Dr. Royle's letter, namely, that when used upon large skins or hides, it caused the leather by degrees to become *red* and *hard*. I have shewn, however, in my letter to you, dated the 30th May, 1845,* the article did not produce these effects upon a *Calf skin*, and it is still my impression, that it will not do so even upon a *hide*. I have just received some fresh Sumach from America, and will test it upon a large hide; the result, I shall place before you in due time. The Sumach I have received, was grown in Sicily, but has come to me by way of America. Should you wish for a small sample to send to Madras, I shall be most happy to supply it.

The other fact stated by Mr. Bruen, regarding the Dividivi, or Sumach, namely, that it is *without much coloring matter*, is what I also have stated in my letter of the 30th May, but this, in my estimation, so far from being any objection to the article, constitutes its chief recommendation; because, as I added at the time, skins tanned with it, could afterwards be dressed into *any color* excepting drab or light yellow.

I shall, however, when my present experiments are completed, report more fully and confidently on the subject.

Kidderpore; Yours, &c.
12*th December*, 1845. (Signed) J. Teil.

* This letter will be found at page 74, Correspondence department, of Vol. IV. of the Society's Journal.—Eds.

My dear Hume,—I have now the pleasure to send you, accompanying this, copy of two communications received from Mr. Teil, dated 14th and 15th instant, together with a sample of the cow hide, and of the Sicilian Sumach with which it has been cured. Be so good as to submit the above to the Agricultural Society at their next meeting. The skin appears to me very fine, both in its general appearance, and cream-white color and its texture. I trust I shall be enabled to furnish Mr. Teil with ample means to test the Dividivi grown in this garden, upon a large hide, which will settle the question as to its applicability for such a purpose.

Botanic Garden; Yours, &c.
17th January, 1846. N. Wallich.

To N. Wallich, Esq., M. D., &c. &c. &c., *Botanical Garden.*

Dear Sir,—In continuation of my letter, dated the 12th ultimo, I have now much pleasure in forwarding to you, a small tin box containing a sample of the Sicily Sumach, I lately received by way of America; also a small cow hide which I have tanned, entirely and exclusively, with some of the same Sumach.

Like the Dividivi, or country Sumach, the foreign Sumach, as is evident from the hide which accompanies, has very little coloring matter in it, and in this respect, it possesses, in my opinion, a superiority over other tanning substances; as leather tanned with it, will admit, as I explained in my letter of the 30th May, 1845, of being afterwards dressed into any color excepting drab and light yellow.

Dr. Royle gives it as the opinion of Mr. Bruen, that Dividivi, if used upon the hides of large animals, will cause the leather to become by degrees hard and of a red color; you will, however, now have an opportunity of judging for yourself of the correctness of this opinion, by keeping the hide, which accompanies, well exposed to the air in some dry place, but where there may not be much dust or risk of injury from insects; and if the result should shew that the hide retains its present flexibility, and that it undergoes little or no change in color, I think you will, in such case, be able to give an opinion upon the quality of the Sumach, as a tanning substance, both foreign and country, very different from that now maintained in regard to it in England.

I have much pleasure in returning the samples of Valonia, which you were so kind as to send me for inspection on the 17th ultimo.

Kidderpore; I remain, &c.
14*th January,* 1846. (Signed) John Teil.

To N. Wallich, Esq., M. D., &c. &c. &c., *Botanical Gardens.*

Dear Sir,—You are perfectly correct in supposing, that *a part* of a hide will answer just as well as an *entire* hide, to enable competent judges to form a correct opinion of the effect of the atmosphere upon it, both as to the color and as to the feel. There cannot therefore be any harm in your cutting up for this purpose, the hide I sent you, in any manner, or in any number of pieces, you may see fit: but to guard against any unnecessary prejudice to the use either of the Sumach or the Dividivi as a tanning substance, it ought to be impressed upon those, whose judgements may be consulted on the subject, that any leather, with whatever substance tanned, will, if long exposed to the atmosphere, or long kept without use, harden more or less, and cause the leather to become of a darker hue than the color, as it appeared, when originally tanned.

I shall, in a month hence, be able, if you wish it, to furnish you with another cow hide tanned with the same substance, and in the same manner, as the one which accompanied my note of yesterday's date.

The Sumach used by me on the hide in question, was not as you have correctly inferred, the Country Dividivi (of which I have not a grain in hand), but the Mediterranean, or Sicily Sumach. The Country Dividivi will however, as I before explained, greatly surpass the Mediterranean Sumach in astringency, and will thereby be much more valuable to the trade, as a smaller quantity of it will go a much greater way, than a larger quantity of the other, or Mediterranean Sumach. It will, however, from having a little more coloring matter in it, give to the leather upon which it may be used, a deeper color than the Mediterranean Sumach; but we shall be better able to judge of this, and of the other point, when you are next able to furnish my firm with a supply of your own Dividivi.

Kidderpore; I remain, &c.
15*th January,* 1846. (Signed) John Teil.

My dear Hume,—I have the pleasure to send you, herewith, half of the cow hide which accompanied Mr. Teil's letter to me of the 14th January last, of which I furnished you, soon afterwards, with a copy as well as a small sample of the hide itself. I now forward the large remnant. I think it has kept its color very well. I have had it suspended, ever since I got it, in my study, exposed entirely to the air. I have likewise the pleasure to send you, herewith, a large good paper of Dividivi seed, just received.

Botanic Garden; Yours, &c.
31*st March,* 1846. N. Wallich.

P. S.—I also beg to send you a tin box with the Sicilian Sumach, to which Mr. Teil's letter refers; you had some from me before.

My dear Hume,—I have very great pleasure in sending you the enclosed extract from a letter, from Mr. Teil, at Kidderpore, dated the day before yesterday; and also part of the piece of bullock hide tanned by the Dividivi, which accompanied Mr. Teil's letter. I am quite sure, that both will be considered of much interest.

Calcutta; Yours, &c.
6*th April,* 1846. N. Wallich.

Extract of a Letter from J. Teil, Esq.,*—dated Kidderpore; 4th April,* 1846, *to* Dr. Wallich.

"I have now the pleasure of forwarding to you, a piece of bullock hide tanned, exclusively, with the Dividivi, which accompanied your letter of the 9th March last.

This piece of leather, which was tanned in the short period of only 96 hours, is, in my opinion, quite sufficient to remove any doubt as to the capability of your Dividivi being used by itself, to advantage, in tanning hides of any substance; and that it surpasses in astringency the Foreign Sumach, and almost equals the Aleppo Galls; although, as I have mentioned in former letters, it contains a little more coloring matter, than either of those two substances, and consequently could not so well be made use of, where very delicate colors are required.

I intended to have made the experiment upon a piece of much thicker hide, but was sorry to find, that the quantity of the drug sent, fell short of what would have been necessary for that purpose.

I have retained a portion of the leather, to ascertain, if any, and what changes, take place upon it by exposure to the air.

As the introduction to this country of the cultivation of the Dividivi, appears to have been crowned by so much success, I should think, with care, and the aid of your long experience, it would not be a very difficult matter to introduce also the Mediterranean Sumach plant, which, there is no doubt, in time would prove as beneficial to trade, as the Dividivi is likely to do.

The Dividivi plants reared in my garden from the seeds with which you so kindly favored me last year, appear to be thriving exceedingly well, as also, are those, which I sent up and had planted in my garden at Patna; so that I hope in the course of two or three years hence, to have the pleasure of gathering an abundant crop of pods from off them."

[All the specimens referred to in the foregoing correspondence, are deposited in the Society's Museum, and are open at any time, to the inspection of the public.—Eds.]

FURTHER CORRESPONDENCE REGARDING THE MANUFACTURE OF INDIGO FROM NERIUM TINCTORIUM.

To J. Hume, Esq., *Honorary Secretary, Agri-Horticultural Society.*

My dear Sir,—I am very glad to find, by Mr Fischer's letter to Dr. Wight of the 8th January last,* that my suspicions relative to the value of the Nerium Indigo were groundless; but I suspect that Mr. Fischer's letter gives the first intimation to the community on this side of India, of the existence of a Nerium Indigo Factory on the Madras side, and for which information, we all no doubt feel much indebted, and shall still feel further obliged, if Mr. Fischer would be kind enough to supply a few more particulars. We have got a superabundance of waste lands belonging to this Presidency, in a similar condition to those which Mr. Fischer states abound in "Southern India," and there are, at present, a considerable body of planters located in the neighborhood of these jungly tracts, who would, I dare say, willingly avail themselves of a less precarious

* For this letter, see Vol. VI. page 129, Correspondence department.—Eds.

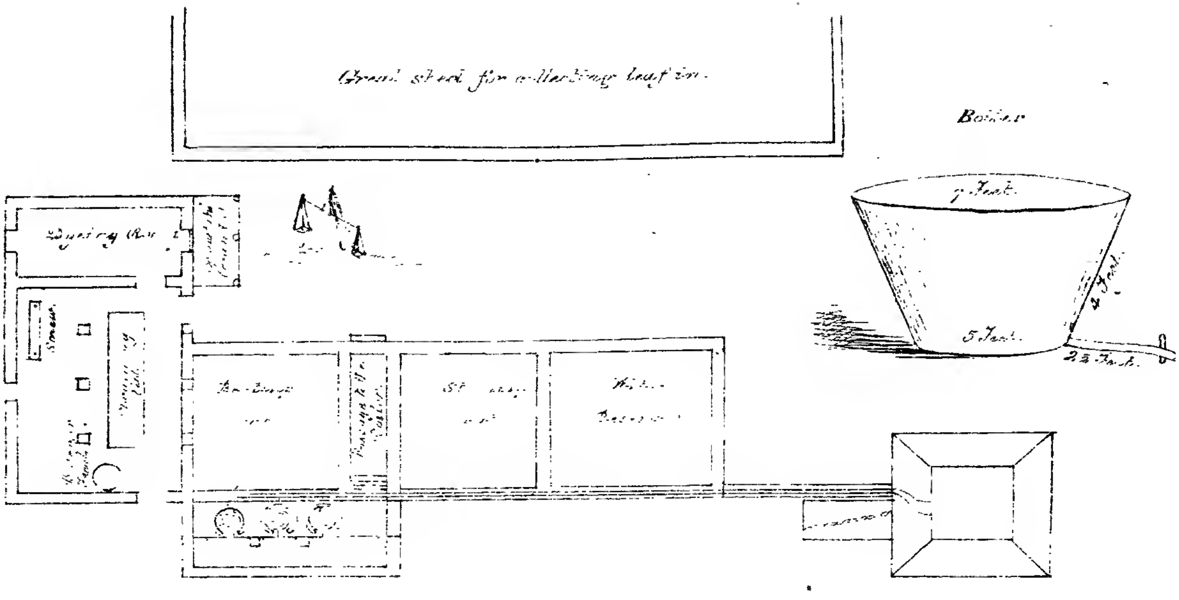
method of producing Indigo, than the existing one, which is so compeletely dependent on the vicissitudes of climate, and exposed to the risks attending the annual sowings of Bengal, and the triennial sowings of the Upper Provinces.

It appears to me, that a plantation of trees would prove more lucrative, than gathering the leaves from the trees distributed by the hand of nature through the country. I suppose the trees, in their wild state, are not found in clusters of many thousands in one spot, but a plantation could be made compact, and would therefore lessen the cost of carriage to the factory; for example, one square mile, allowing each tree to be planted distant from one another 7 feet, would contain 568,960 trees: a square mile is equal to 1,936 Bengal Biggahs of 14,400 square feet. This would not be considered a very large factory, and supposing the works were placed in the centre of this plantation, the leaves would only have to be conveyed half a mile to the factory. Should any planter, however, on this side of India, attempt to form a plantation of Nerium trees, it would, I should think, be advisable to combine both species of cultivation like that of Mr. Fischer, the annual or triennial shrub with the tree: but before any one could safely commence with such a business, it would be necessary to know how far the trees ought to be placed apart from one another, as I have only conjectured 7 feet to be the probable distance. We also require to know how many pounds of leaves a full grown tree is found to bear each season, likewise the size and construction of the boilers, and whether the beating vat that is used in manufacturing Indigo from the common plant, is also used without any partition in it, for beating the heated liquor from the Nerium leaves; if so, it will indeed take a large and expensive boiler.

I think I am speaking the sentiments of the Members, when I say, that we should be extremely obliged by Mr. Fischer's affording us the information, which I have taken the liberty to solicit. We should also be glad to know the nature of the improvement made by the Superintendent of Mr. Heath, in the beating apparatus, and which Mr. Fischer alludes to in his communication to Dr. Wight.

If you agree with me in considering it necessary to obtain all the information which I have asked for, perhaps you will have the

Ground-plan of an Indigo factory at Salem.



goodness to forward my letter to Mr. Fischer through Dr. Wight. I think we must have further information relative to the Nerium, before we meddle with it on a large scale, as with the limited knowledge we have at present, we should be groping our way in the dark.

Palamow; I remain, &c.
2nd December, 1845. C. B. TAYLOR.

Extract of a Letter from G. J. FISCHER, ESQ.,—*dated Salem,* 12*th January,* 1846, *to Dr.* ROBERT WIGHT, *at Coimbatore.*

I have at length found time to give attention to the letters you sent me from Bengal, requiring information on the subject of making Palah Indigo. The points on which additional information is sought by Mr. Taylor are as follows :—

1. The distance that the Palah trees should be planted?
2. How many pounds of leaf a full grown tree will bear each season?
3. The construction and size of the boilers required?
4. The size of the beating vat?

And these points I shall answer in their order.

1st. The trees should be more then 7 feet apart, I should say 10 at least; for the more room they have, of course the more they will expand and the more luxuriant they will be. They might be planted thicker at first to allow for failures, and cleared away afterwards.

2d. A full grown tree, such as are met with in the jungles, yields from 40 to 100 ℔s. of leaf, according to circumstances of soil, locality, and treatment: and the trees may be cut twice a year. It takes from 150 to 200 ℔s. of leaf, to give a pound of indigo, and that quantity of leaf coming, some times, 3 and 4 miles on the ryots' heads, cost us 3 or 4 annas.

3d. The boiler should be of the shape and size of the annexed sketch, smaller would do, but larger would be inconvenient; and 2 or 3 boilers should be made to empty themselves into one vat.

4th. The size of the vat should be so constructed as to contain one foot of water in it, when the 2 or 3 boilers are emptied into it. The fire-places should be constructed upon the most improved and efficient plan with reference to the greatest heat attainable, at the least expenditure of fuel.

I think I have now given Mr. Taylor all the information wanted. To give him an idea of our mode of working, I send him the ground plan of one of our small factories which I happened to have by me. We do things upon a very small scale, to what they do in Bengal.

In conclusion, I beg you will make my acknowledgements, both to Mr. Hume and Mr. Taylor, for the flattering way in which they speak of me, and the trifling service I have rendered.

REPORT ON TWO FLEECES OF WOOL, A CROSS BETWEEN A SOUTHDOWN RAM, AND PATNA EWE.

To the Secretary, Agricultural Society.

MY DEAR SIR,—I beg to send you two Fleeces, shorn from yearling lambs, the quality of which appears to be an improvement upon the Bengalli.

The lambs are the produce of Patna Ewes, by an imported Southdown Ram, and were bred by Mr. Ricketts of Chittagong.

Tipperah; Yours, &c.
Nov. 18th, 1845. F. SKIPWITH.

Report on the above Fleeces.

Mr. Speed having solicited me to give my opinion as to the quality of the two Fleeces of Wool, forwarded by Mr. Skipwith to the Agricultural Society of Calcutta, I do so with much pleasure.

The wool is decidedly of a very good quality for the first cross, uniting length of staple, and (for the sort) softness, with great uniformity of quality throughout the fleece, which is much desired; the quality, from its coarseness, will not admit of being used for other than blankets, and very coarse cloth; its market value at present in the home markets, is about sixteen pence per ℔.

I consider, that Mr. Ricketts has acted correctly, in having crossed the Patna with the Southdown, and should strongly recommend him to carry out the improvement, by crossing the production with the Merino, as he only requires now, the texture, he having procured the length of staple, with carcass.

India can, in my opinion, if sufficient care were displayed in the several crosses, produce as good a sample of wool as any of Her Majesty's Dominions, from the luxuriance of the feed and the temperature of the climate; as texture, with length of staple, is all that is necessary.

To produce a flock embracing strength, carcass, and fineness of wool, I recommend the Patna Ewe, crossed with the Southdown Ram, then followed by a cross of the Merino; if the Southdown Ram cannot be obtained, the Leicester Ram may be used; but though it will produce carcass, the texture of the fleece will be wanting to a considerable degree, consequently, requiring a second cross of the Merino, before the necessary fineness is obtained.

Calcutta; 19th January, 1846. W. STALLARD.

REMARKS ON CERTAIN SPECIMENS OF WOODS FROM CENTRAL INDIA. PRESENTED BY COLONEL H. C. M. COX.

MY DEAR SIR,—Some days since, I dispatched a parcel to your address per dawk banghy, containing specimens of Nerbudda and Soane Teak, and also some specimens of *Khurkur,* a fine grained, hard, but flexible wood, which would answer admirably, I think, for the sheaves of blocks for shipping, as it takes a beautiful polish.

To day, I have sent you a small box with specimens of the Nerbudda Coal.* Had the 58th remained here another year, I would have sent you a great variety of specimens of wood, as the jungles about Mundelah, contain a very great variety of woods, many, I dare say, as yet unknown to Europeans. There is also a specimen of a very beautiful wood found near Mundelah, called *Dangun,* which I have sent you; it is very strong and flexible.

Jubbulpore; 26th February, 1846.

Memorandum.

No. 1. N. Three pieces of old teak, taken from a plank, twenty inches broad, of Nerbudda Teak, or more properly, from Mundelah; but it is floated to the neighborhood of Jubbulpore by the Nerbudda.

* A report on this Coal will be found a few pages further on.

No. 2. N. Three pieces from another plank of Nerbudda Teak.

No. 3. S. Are two small pieces from a thin plank about sixteen inches broad, which was brought to me from Sohagpore near the Soane river, where there are extensive forests of teak.

No. 4. Are three specimens of a very beautiful wood, called *Dhamen* or *Dangun*;* it grows to a large size, is elastic, and makes good fishing rods; it can be got, sometimes, large enough to give twenty and twenty-two inch planks. One bit has had a little varnish put on it.

* Captain W. Munro, H.M. 39th Regt. having recognized this wood to be the same as that alluded to by Mr. Wm. Griffith in a paper entitled, "Remarks on a few plants from Central India," which is published in the Calcutta Journal of Natural History, Vol. III. it is thought that the following extract from that paper will be interesting to many who may not have the work at hand to refer to:—

"This plant belongs to the Natural family, *Verbenaceæ;* it is interesting for being allied to the Teak, and to which affinity it owes its valuable properties as a Timber tree. It appears to me unknown to science.

Hemigymnia.(a) *Calyx* infundibuliformis, striatus, 5 dentatus. *Corollæ* tubus infundibuliformis; laciniæ 5 (angustæ, tubo duplo longiores). *Stamina* 5 aqualia, inclusa. *Ovarium*, 4 loculare, 4 ovulatum: ovula solitaria, ascendentia. *Stylus* bifidus, rami profunde bipartiti, intus stigmatosi. *Fructus* (immaturus) drupaceus, rostrato-cuspidatus, calyce cupuliformi semicinctus.

Arbor *mediocris;* partibus novellis pube ramosa tomentosis. Folia *opposita, cordata, vel cordato-rotundata.* Inflorescentia *terminalis, cymosa-corymbosa.* Flores *congesti, in apicibus pedicellorum brevium articulati, mediocres, albi?*

Habitus quodammodo Rottleræ, aspectus florum Lythraricus, Pemphidis si velis.

Hemigymnia Macleodii.(b)

Habitat: Sylvæ Jubbulpore vicinæ, plerumque cum Tectona consociata.

Mr. Macleod remarks of this tree, "that it is called by the natives Dahman or Dahyan, and is abundant in our jungles; it is not to be found at a less distance than from thirty to forty miles from Jubbulpore; it is almost always, if not in every case, in association with the Teak, but in less quantity than that tree. It grows to a considerable size, and has a thick stem, not quite so tall as that of the Teak, but of greater proportional compass. The wood is remarkable for its great strength and elasticity; its properties appear to resemble those of the lance wood." In answer to my enquiries, whether the timber might be introduced to some of the great marts of India, Mr. Macleod states, "Both this and the teak are found on the banks of the Nerbudda, and are floated down to Jubbulpore as late as the month of December; from hence I apprehend they might be floated in the rains,

(a) In allusion to its half-naked fruit, in contradistinction to that of Tectona.

(b) I have named this after its discoverer, one of the ornaments of the distinguished service to which he belongs.

No. 5. Are specimens of a very valuable, close grained wood, called *Khurhur;* extremely hard, strong and flexible, used for buggy shafts, and would be an excellent substitute for Lignum vitæ and box wood for the sheaves of blocks.

It does not attain any great size. It is a species of *Carissa,* I believe; is thorny, and bears a coarse fruit, about the size of an egg.

No. 4. Is said to be medicinal; refined to powder, it acts as an emetic, and is used to prevent any bad effect from an over dose of opium: such is the native account I received.

H. C. M. Cox.

CORRESPONDENCE ACCOMPANYING A BOX PRESENTED TO THE SOCIETY, MANUFACTURED FROM MAHOGANY, PRODUCED IN THE H.C. BOTANIC GARDEN, CALCUTTA.

From the Under-Secretary to the Government of Bengal, to the Secretary to the Agri-Horticultural Society,—dated Fort William, 30th March, 1846.

Sir,—I am directed to transmit an extract from a letter, from the Superintendent of the Honorable Company's Botanic Garden, dated the 23d instant, together with the oblong paper box therein referred to, for presentation to the Society.

I am, &c.

Cecil Beadon,

Under-Secretary to the Govt. of Bengal.

(unless the falls at Bhera Ghaut, should be an insuperable obstacle,) to the sea. The wood from above Mundelah, however, cannot thus reach us, as near that place, there are falls which form an insuperable barrier at all periods. As far as I can judge, I should doubt whether the wood, either of this, or of the Teak, are either in size or quantity, sufficient to render them available for general export from this remote locality."

This genus appears to me more nearly allied to Tectona, than to any other of the same Natural family: it differs, however, abundantly from that genus in its calyx and corolla, the not exserted stamina, the division of the styles, and half-naked fruit like those of Tectona; its leaves are rough from siliceous (?) deposits. The other regular-flowered verbenaceous Indian genera, with which it may be necessary to contrast it, are *Sphenodesme. Symphorema, Callicarpa, Hymenopyramis,* and perhaps *Glossocaryâ.*"

Extract from a letter from the Superintendent of the Honorable Company's Botanic Garden, to the Under-Secretary to the Government of Bengal, No. 16,—*dated the 23d March,* 1846.

"Para. 2.—As the Mahogany is a tree of great value and beauty, and capable in my humble judgement, of being produced in this country, of a size and quality very nearly, if not entirely, equal to the best Spanish kinds from the West Indies and the Bay of Honduras; I have had the accompanying three specimens prepared by two of the leading cabinet makers of Calcutta, from Mahogany produced in the low grounds of this garden; which I solicit may be laid before the Honorable the Deputy Governor of Bengal. They consist of,—

1st. A tea-catty made by Messrs. Shearwood and Co., copy of whose report contained in a letter to me, dated the 6th August, I beg leave to enclose. I wanted the firm to make me a plain box of the description ordinarily used for holding papers, but they thought that the quality of the wood, would be best exhibited in the shape of which they have made the box.

2d. An oblong paper box made by Messrs. Lazarus and Co. This and the preceding, have been made from planks of timber, felled in this garden about three years ago.

3d. Part of a segment of the base of a very large Mahogany tree, which was killed by lightning here in 1837; being then, I presume, about forty-five years of age. This section does not comprize, the actual centre of the trunk, which had been completely destroyed, to the extent of a hand's breadth in diameter. This very instructive and beautiful specimen, was also prepared and varnished by Messrs. Lazarus and Co., whose recent failure has prevented my obtaining from them, their promised report.

Para. 3.—I most respectfully solicit, that the tea-catty, and section mentioned above, may be presented to the Honorable Company's Museum at the India House, where I am convinced they will be much prized; and that the oblong box may be presented to the Agricultural Society of Calcutta, who can easily be furnished with a section of the same trunk, from which the other has been taken."

From the Under-Secretary to the Government of Bengal, to the Honorary Secretary to the Agri-Horticultural Society,—dated Fort William; the 7th April, 1846.

SIR,—With reference to your letter of the 1st instant, I am directed to transmit a copy of Messrs. Shearwood and Co's. report therein alluded to, and to intimate, that the Superintendent of the Honorable Company's Botanic Garden, has been requested to forward to you, a section of the trunk of the Mahogany tree, from which the box, presented to the Society, has been manufactured.*

I have, &c.

CECIL BEADON,

Under-Secretary to the Government of Bengal.

DR. N. WALLICH.

SIR,—We beg to wait on you with a small tea-box made of the plank of Mahogany, sent to us by you, from the Botanic Garden; it is made entirely of the plank sent, and if it could have been kept a little longer, before polishing, it would have been a much better color.

We are of opinion, that if the tree from which the above plank was sawn out, had stood a few years longer, it would have been much more solid in its grain, and a better color, and fully equal to Honduras Mahogany. Yours, &c.

Calcutta; 6th August, 1845. (Signed) SHEARWOOD & Co.

DIRECTIONS FOR THE CULTURE OF MAHOGANY IN BENGAL, COMMUNICATED BY N. WALLICH, M. D.

The Mahogany seeds should be sown flat and separate in a light soil, covering to the thickness of about ½ an inch, and watering gently every evening; of course the pots or beds should be shaded from the severe heat and sun. At this season, the seeds will germi-

* This has been since received and placed with other specimens in the Society's Museum.—EDS.

nate, on an average, in 16 days: I have known them to come up in this very month, so early as 11 days, and in 23.

As soon as the seedlings have attained the height of 3 or 4 inches, they should be transplanted into pots separately. They may be placed out when they are one year old: that is, the seedlings of this time, should not be planted out until the rains of 1847.

I cannot refrain from mentioning, that I have seen this month, for the first time, two Mahogany seeds, which had actually commenced germinating on the tree in this garden, in the capsule containing them!

Botanic Garden; 27th March, 1846.

COMMUNICATION ACCOMPANYING TWO TABLES MADE FROM TEAK AND SISSOO, THE PRODUCE OF THE H.C. BOTANIC GARDEN. PRESENTED BY C. K. ROBISON, ESQ.

To JAMES HUME, ESQ., *Secretary to the Agricultural and Horticultural Society of India.*

DEAR SIR,—I have the pleasure to send for our apartments in the Metcalfe Hall, two Lobby Tables, which I long ago got made up for, and presented to the Society, but which circumstances prevented me sending till now.

These Tables possess an interest in being made from Teak and Sissoo, grown in the Company's Botanical Garden, and given to me by our late lamented Vice-President, Mr. Griffith, for the purpose of trial how far they were fit for furniture or building; so as a report might be sent by him to Government. This the Society will judge of; to myself they have appeared of very superior quality; the Teak, in particular, surpasssing nearly all I have seen in closeness of grain, and capability of polish.

I am, &c.

Calcutta; 10th February, 1846. C. K. ROBISON.

[The best thanks of the Society were given to Mr. Robison for this handsome present.]

CAPABILITY OF THE SOIL AND CLIMATE OF CHOTA NAGPORE FOR THE PRODUCTION OF COFFEE.

Extract of a letter from Lieut.-Colonel J. R. OUSELEY,—*dated Chota Nagpore ; 9th February,* 1846.

"I send you down by dâwk bhangy, some cleaner Coffee for use; half a seer from trees seven years old, and one seer from trees of four years; as it was said to be better than any, without exception, in Calcutta, Mocha, Bourbon, Ceylon, &c., included; I should like your opinion on it.

The Government Garden here, is flourishing, and next year will bear; the Coffee plant appears to like the soil and climate wonderfully.

The Wheat (Nerbudda) and white Linseed, has grown beautifully this year. I trust the seed I sent has done so with you: the straw of the Wheat is four feet in height, and some of the ears six inches and upwards in length. I am glad that it appears to answer here."

Report on the above specimens of Coffee, by J. COWELL, *Esq.*

"The specimens which you have sent for my opinion are very good. The bean appears of a good stock, resembling Mocha, and bears all the characteristics of Coffee produced in a dry climate, viz., smallness with plumpness of bean, and a considerable degree of fragrance.

It would be desirable to ascertain from Col. Ouseley, the stock from which he reared his trees, and under what circumstances he has succeeded in producing a Coffee of such desirable qualities and appearance; and whether, on an extended scale of cultivation, he could manage to produce an article equally good in all respects, with probable cost, &c. per maund; also whether his cultivation is in the plains, or otherwise.

I would suggest that a quantity of this Coffee be packed in a barrel (a flour barrel is generally what is used in the West Indies, the more effectually to prevent the article from any taint by other cargo in transit) and sent home for the particular opinion of some experienced Coffee dealers in London. I think, that these specimens only require age, to rank them with superior Mochas in flavor and appearance.

28th February, 1846.

My Dear Mr. Hume,—I am much obliged to you for your note of the 2d October, to the Coffee grown by me here. Please to inform Mr. Cowell, that the stock is Mocha, furnished to me, some years since, by the Superintendent of the Government Gardens, Calcutta. It appears to thrive so well, that with little trouble and expense, any extent of land might be employed in plantations of Coffee. We are between 2 and 3000 feet above the sea, on a table land: the soil is dry, also the air. On a large scale, I do not suppose, that the Coffec would cost more then eight or ten rupees a maund, but this would be two or three years hence. I have the pleasure to send you 12℔s. of the same Coffee as a sample, to test in Calcutta and England.* I have given all mine away as seed, sending a little to Messrs. Vansittart and Lindesay, at Meerut and Delhi, to sow in the Hills, and to the Zemindars here, in Surgooja, Jushpoor, Sumbulpoor, &c., and to all inclined to try the experiment of growing it.

Chota Nagpore; Believe me, &c.,
13*th March,* 1846. J. R. Ouseley.

RESULTS OF ANALYSIS FROM SPECIMENS OF NERBUDDA COAL; FORWARDED BY LIEUT. COL. H. C. M. COX. COMMUNICATED BY J. M'CLELLAND, ESQ.

To James Hume, Esq., *Secretary, Agricultural and Horticultural Society.*

My dear Sir,—I have the pleasure to annex the results of analysis obtained from the specimens of coal which accompanied your note of the 19th.

At the suggestion of Mr. Scott, the laboratory assistant, I have subjoined to the table, the results obtained from the analysis of Scotch Cannel Coal, to show how nearly the Nerbudda specimens received from Col. Cox, correspond with it.

The specimens are not quite alike, and the sample is too small to form any very satisfactory result from. They seem different from

* Three-fourths of this supply have been forwarded for report to the East India and China Association.—Eds.

the specimens heretofore received from the same quarter, which, though superior, were of the ordinary slaty kind, from which this differs, in the hard compact structure which allows of its being handled without soiling the fingers, as well as in its resinous or waxy lustre, which are all character of Cannel Coal.

Cannel Coal has only been found hitherto in India, in the Tenaserim Provinces; this seems to be the first indication we have had of its existence in the Nerbudda.

I need not add, that it seems to be remarkably fine Coal, and in addition to the ordinary purposes of steam, would answer for Coke and Gas.

As a further satisfaction to the Society, I have requested Mr. Scott to append his note to the analytical results.

Yours sincerely,

28th March, 1846. J. M'CLELLAND.

Nerbudda Coal forwarded to the Agri-Horticultural Society. By Lieut.-Colonel Cox, *Jubbulpore.*

Locality.	Quality.	Specific gravity.	Composition in 100 parts.			From whom received.
			Volatile matter.	Carbon.	Ash.	
Not stated further than above,	Cannel coal,	1·3	59	37	4·	Secy. Agri. Horti. Society
Composition of Scotch cannel coal,		......	56·57	39·430	4·	

The above result is very similar to the analysis made by Mr. Mushet of Scotch Cannel Coal. It would answer admirably for the manufacture of Coal Gas; as on referring to many results of analysis given by Kirwan, Mushet, and others, I find no variety of Coal examined by them, so productive of volatile matter. J. G. SCOTT.

RESULT OF AN EXPERIMENT ON THE BUSSORAH ROSE WITH PERUVIAN GUANO.

It is not because the following satisfactory result of a trial with Guano, possesses any particular interest *per se*, that I venture to bring it to notice. I do so, in the hope of inducing others, who may have had opportunities of trying this fertilizer on a more extended scale, to submit the substance of their experiments to the Society; under the conviction, that it is only by the communication of such results, that we can arrive at any satisfactory conclusion, in regard to the general applicability of this manure to different kinds of soils and crops.

My experiments, during the past year, have been made on flowering plants and shrubs generally. I shall, however, confine these few remarks to trials on the Bussorah Rose, as they were more carefully carried out, than the others; and I am, consequently, enabled to speak more decidedly regarding them.

I may mention, in the first place, that I have adopted the usual custom of cutting down my Bussorah Rose trees twice a year. On two or three occasions, I have manured the roots with rotten fish, and on one occasion, with stable manure; the results, however, have never proved satisfactory; the trees, it is true, frequently gave healthy, vigorous shoots, but almost always flowered sparingly; this I attributed rather to the age of the plants, than to a want of efficacy in the stimulants employed; and, but for certain associations connected with them, should have substituted other and younger plants in the spot which they now occupy.

Having thus failed with the usual manures, I determined to see if the application of Guano would give a more favorable result, and, with that object in view, procured a few seers from the Society in the early part of last year.* Having, as usual, cut the plants down nearly to the ground in March, shortly after they had ceased flowering, I opened the earth and starved the roots for a month or so. When the fresh sprouts had fairly covered the trees, I

* Being a portion of the supply presented to the Society by W. P. Grant, Esq.

sprinkled a small quantity of *dry and unadulterated Guano, a couple* of ounces or so, round the roots of each plant, and then replaced the mould, which had been taken out a month previously, in its original position. The plants grew up, healthy and strong, but not more so than had been their wont, nor, so far as the foliage was concerned, was any material difference apparent. But when the rainy season had well set in, a decided change was perceptible. Then full one-half of the number of branches threw out blossom, and the trees were not only well covered with them, but continued bearing, till so late as the close of October.

Encouraged by a result favorable beyond expectation, I determined on repeating the experiment less cautiously than before. Having therefore cut down the old branches, in the early part of November, and allowed the roots to starve till the end of that month; I caused 6℔s. of Guano, in a dry state, to be well mixed up with the mould which had been removed from the roots, and the holes to be filled up with this mixture, having previously directed a *kolsee* full of well-water to be given to each plant. As the plants were only six in number, we may assume, that each got a proportion of about one pound of the manure. Watering was continued every evening from that period, but the manuring was confined to the one application already alluded to. At the commencement of December, the first buds appeared; these were speedily succeeded by a profusion of blossom, till the trees were fairly covered. The flowering continued till the end of last month; the size of each flower being much the same as in former years. I mention this, as it has been frequently remarked, that Guano has the effect of diminishing the size of many kinds of flowers. I may add, that the soil in which these trees are placed, is by no means a rich one, and had not been previously manured, which may partly account for the Guano having proved so efficacious, it being generally admitted, that a quantity, which will become deleterious upon land previously rich and well manured, will prove highly beneficial in a poorer soil.

I may mention, that all my attempts to improve the turnip-radish, by cultivating it in a Guano-manured soil, have failed. I made the experiment during the last cold season with American, English, Cape and Lucknow seed; all germinated freely, and the plants grew

healthily, but the roots were by no means well flavored, being stringy and hot, and becoming very woody before they had attained maturity. Radishes grown in 1844 in the same soil, unmanured, gave a much better tasted produce.

Calcutta; 9th March, 1846. A. H. B.

Since writing the above, I have been favored by Mr. J. W. Laidlay, an active and zealous Member of the Society, with an analysis of the soil in which this experiment was made; it is as follows:—

Moisture, ...	2· 86
Humus and humic acid, ...	0· 60
Extractive matter with traces of sulphates, chlorides, phosphates, and ammonia, ...	0· 10
Organic matter destroyed by heat, ...	3· 41
Sand and silica, ...	76· 45
Carbonate of lime,..	4· 24
Carbonate of magnesia, ...	1· 44
Alumina, ...	5· 40
Protoxide of iron, ...	4· 48
Loss, ...	1· 02
	100· 00

RESULT OF EXPERIMENTS ON SUGAR-CANE WITH PERUVIAN GUANO. COMMUNICATED BY J. W. PAYTER, ESQ.

To James Hume, Esq., *Honorary Secretary to the Agri-Horticultural Society of Calcutta.*

Dear Sir,—In conformity with my promise to communicate the result of my trials with the Guano manure, I beg to say, that I am greatly disappointed in my expectations of its much vaunted fructifying powers, at least as regards Sugar-cane cultivation; my experiments have been confined to its use on poor soils, and in that respect, I do not consider it a whit superior to *(Khyle)* oil-cake and *old* cow-dung judiciously mixed; indeed if we take into consideration the fact, that *Khyle* protects the cane from the ravages of white-ants, and the Guano does not, we must allow the former the preference.

By one of my experiments, viz.—the removal of 120 stoles (earth and all) from a poor soil, where they had been planted on the 17th March, and removed on the 22d and 23d July into a richer soil, when a couple of handfuls of the Guano was carefully put at the bottom of each stole, it was found, they were all attacked by white-ants on the 15th and following days, and in the succeeding wet weather; during two months, more than half were destroyed. I should have previously stated, that these canes when first planted, were dipt into a thick solution of the Guano. Their present state is such, as not to warrant the expectation of a cutting this season.

In the garden, the Guano is certainly a great advantage. I used the remaining quantity I had, in preparing a strawberry bed late in November and immediately planted out; the result was instantaneous, their beginning to shoot; and I have now a most magnificent crop.

For general agricultural purposes on a large scale, I should say, that Guano is a failure, that is, as regards Sugar-cane in particular. It will not repay the planter the trouble and expense of getting it up from Calcutta to any distance, even if he got it *gratis*. The purchase of oil-cake in his own vicinity, even if it be as dear as it is in this neighbourhood, that is, 2½ maunds for a rupee, would be far more economical, and I venture to say, equally as efficacious.

Paunchbibbee, Bogoorah; I remain, &c.,
15*th February*, 1846. J. W. PAYTER.

PROGRESS OF SILK CULTURE IN THE MYSORE COUNTRY.

To JAMES HUME, ESQ., *Secretary Agri-Horticultural Society of Calcutta.*

MY DEAR SIR,—I do myself the pleasure, by desire of the Committee of our Society, to forward herewith, copy of the Proceedings of our last Meeting, to award prizes for articles of staple produce. But few articles were produced, owing to the competition having been confined to East Indians and Natives, a restriction which it is proposed to remove, in offering prizes for this year.

I am desired to forward two hanks of raw silk, the produce of the Sircar Gardens at Bangalore in Mysore, and to request, you will kindly favor us with the opinion of your Society and Chamber of Commerce, on its merits? It is here considered a very superior article, and we are informed, that it fetches at Bangalore, four rupees per seer of twenty-four rupees weight.

Captain Haines of the Mysore Commission, who sent the silk for exhibition, has been requested to procure for us a detailed statement of the description and treatment, &c., of the worms which produce it, and if desired, I shall be happy to forward you a copy of the account when received. Yours, &c.

Madras Agri-Horticultural Society's Gardens; F. S. GABB,
26th February, 1846. *Secretary.*

Proceedings of a Special General Meeting of the Madras Agri-Horticultural Society, held at the Society's Gardens, on Wednesday, the 18*th February,* 1846—*to determine on articles sent to compete for Government prizes, for* 1845-46.

The Honorable H. Chamier, Esq., *President in the Chair.*

Present.

Major General Sir F. K. William, K.C.B., *Vice-President.*

J. Ainslie, Esq.	W. McTaggart, Esq.
J. Arathoon, Esq.	J. Ouchterlony, Esq.
G. D. Drury, Esq.	T. B. Roupell, Esq.
J. U. Ellis, Esq.	S. Sam, Esq.
Captain F. S. Gabb,	

The following samples of articles sent to compete for Prizes, are laid before the Meeting:—

Articles Submitted.	*Decision of Committee.*
160 lbs. of Coffee, grown by Ram Sing of Tinnevelly, on the Courtallum Hills, accompanied by a detailed statement of mode of culture, &c.	This Coffee is considered a clean, nice colored Coffee, but not a very superior quality. The Committee recommends the 2d Prize of 100 Rupees be granted to Ram Sing for the above.
No other Coffee sent for competition.	

2 Cart loads of Raw Sugar, grown and manufactured by Mr. McDowell, (an East Indian), in his Farm at Venkatergherry.

No other sugar sent to compete.

The Committee pronounces Mr. McDowell's Sugar to be a fair, ordinary, yellow Sugar, and does not consider it entitled to the 2d Prize, but under Rule I. of the conditions, recommends an award of Rupees 100 to Mr. McDowell for his Sugar.

22 lbs. of Raw Silk (white and yellow) the produce of the Sircar Gardens, Bangalore; forwarded by Captain Haines, Superintendent of the Bangalore Division of Mysore.

The value of this Silk at Bangalore is stated to be Rupees 4 per seer, of 24 Company's Rupees weight, or 1-6th of its weight in silver.

This Silk is considered of very superior quality, and would be entitled to the 1st Prize, had the conditions required by the Rules for competition (published in Gazette, 30th May 1845, and following Gazettes) been complied with.

The conditions required, are:—

1st.—That not less than 40 lbs. be produced.

2d.—That minute details of the method of cultivation and manufacture be given. It should further have been intimated, whether the articles shewn are bona fide productions of East Indian, or Native cultivators.

The Silk produced is of so superior a quality, that the Committee would feel much obliged by Capt. Haines procuring for them a detailed statement of the description of worms, method of rearing, description of leaf on which fed, process of reeling, &c. &c., which has been pursued at the Bangalore Sircar Gardens.

A sample of the Silk is ordered to be sent to the Chamber of Commerce, Calcutta, for report, and the Secretary of this Society will be pleased to communicate the result to Captain Haines.

40 lbs. and upwards of Raw Silk (white and yellow), by Padsha Saib of Madras, the produce of his establishment.

This Silk is of ordinary quality.

The Committee, however, considering the great exertions made by Padsha Saib to grow Silk at Madras, and the disadvantages from climate and proximity to the Sea, under which he labors, recommends the 2d Prize of 200 Rupees may be given for his Silk.

No other articles were produced, owing probably to Europeans having been excluded from competition,—a restriction which will be removed in recommending Prizes for 1846-47.

(Signed) H. CHAMIER, *President, in the Chair.*

Report of the Silk Committee on specimens of Raw Silk, the produce of the Sircar Gardens at Bangalore; forwarded by the Agricultural Society of Madras.

Your Committee have examined these specimens with great interest, and should be prepared to give an unqualifiedly favorable opinion on them, had the thread been a very little stronger. As it is, it is remarkably even, round, and free from knibs and gouts, and the color very pure and uniform; indeed, with the single exception of being somewhat too fine, the present are most admirable samples of silk.

Your Committee would, however, remark that an opinion often prevails among such as are not practically versed in the manufacture, that the *finer* the silk, the better and more valuable; but it may be too fine, and the present specimens, your Committee think, are finer than it would be safe to prepare for the English market, for the difficulty of unwinding such silk is extreme, and adds enormously to the charge of preparing it for the weaver. A Member of your Committee (Mr. Laidlay) observes, that he has known, in more than one instance, the most disastrous results from the mistake of reeling the silk too fine, for it will not bear to be unwound by the machinery used for the purpose in Europe.*

Your Committee, however, beg to add, that these specimens are, in every other respect, unexceptionable. So clear, even, and beautiful, that the reeler who prepared them, may be pronounced competent to produce silk of first rate excellence, nearly, if not quite, equal to Italian. The soil and climate too must certainly be favorable to the culture.

Calcutta;
March, 1846.

ROBERT WATSON,
J. W. LAIDLAY,
C. K. ROBISON,
G. T. F. SPEEDE.

* Mr. Laidlay submits for inspection and comparison a skein of the finest Fossombrone silk, the thread of which, it will be perceived, is much stronger than that of the Bangalore samples.

RESULT OF TRIALS GIVEN TO VARIOUS SEEDS AT CHANDAMAREE FACTORY, RUNGPORE. COMMUNICATED BY H. REHLING, ESQ.

Chandamaree; 15th October, 1845.

MY DEAR SIR,—In accordance with my promise, I have the pleasure to send you the following account of the experiments I have made, with the different seeds and plants you so liberally supplied me with; press of business, combined with other causes, has prevented my sending it before: I trust it may be acceptable to you.

I am glad to report the success that has attended my attempt at cultivating the American sumach. I have succeeded in raising about thirty or forty plants, which are thriving most luxuriantly; some of them have attained the height of seven feet and upwards. I have supplied some of my friends with a few plants, thus affording this useful tree, the opportunity of being introduced at different localities in this district. I need not say, that if you could send me a larger supply of seed next year, that it will be very acceptable.

I am sorry to say, I cannot report so favorably with regard to the supply of French madder seed you kindly sent me by letter dâk, for my experiment has proved a failure. I sowed part of it on receipt, but experiencing very heavy rain soon after, not a single seed vegetated. I sowed again in the early part of September, but not with better success. A few days ago, I made another trial from the supply I received from you by my boat, and I have, besides, distributed it to several parties at different localities; if the experiments are attended with success, I shall not fail to report the result to you. Should you have succeeded in raising plants at the Society's Nursery, a few of them will be very acceptable to me.

My Bourbon cotton, planted in May 1844, is thriving remarkably well, the plants have put forth fine large leaves, and are crowded with blossoms. The New Orleans cotton, planted at the same period, does not appear to thrive so well. The Bourbon cotton plants have attained the height of seven and eight feet. In due course, I shall not fail to send you samples of the produce.

I was glad to notice Mr. Welby Jackson's remarks on Rungpore, in the last No. of the Society's Journal. [No. II of Vol. VI]; it will

throw some light on the real state of Agriculture in this district. I cannot agree with Mr. Jackson as to his remark on tobacco, as I do not think any material falling off in export has taken place; for although there is four times the quantity of sugar-cane cultivated now, as eight or nine years ago, which should be the only reason, if any actual decrease in the culture of tobacco should have taken place, I find that tobacco is as extensively cultivated at present, as eight or nine years back; the cultivation may have been reduced in some parts of the district, but it has again been extended in other parts.

I have also perused, with interest, Mr. C. B. Taylor's remarks on the Nerium tinctorium, but I am very sceptical as to the assertion brought forward,—that the substance obtained from this plant is obtained with less labor and at a less cost, than that yielded by Indigofera tinctoria. A few remarks on the subject will not be out of place, particularly as Dr. Wallich very justly remarks, that some weighty ground must be the cause for this plant not being extensively cultivated. The circumstance that you are obliged to subject the leaves of the plant to the action of hot water to extract the coloring matter, will at once convince the planter, that the dye cannot be produced at so cheap a rate as that of Indigofera tinctoria, the manufacturing process of which merely consists in steeping the plant leaves in cold water, and subjecting the water to agitation, the sediment only being subjected to boiling. The daily comsumption of water at an indigo factory is very great; the expence of fuel required to heat the water must be very heavy, and the outlay the Planter will be put to, in erecting boilers of sufficient dimensions to produce any thing like 100 maunds, will be enormous; besides this disadvantage, I very much doubt if sufficient waste lands could be obtained, at one spot, for the culture of this tree in Bengal; and as some years must eventually elapse, before the tree can come to maturity and yield leaves, the cultivation of it can never pay, unless lands can be obtained at a very low rate of rent. These circumstances will tend more than to counterbalance any other advantages the plant may otherwise possess. The supply of seeds of the Nerium tinctorium you sent me, proved a failure; not a single seed vegetated. Whilst on the subject of indigo, it will be well worth bringing before the notice of the Society, that the Egyptian indigo plant is said to contain the coloring matter in

greater abundance than the Bengal plant. I think the subject is well worth the attention of the Society, and that much benefit may be derived by the introduction of the Egyptian plant into Bengal. To judge from the description Mr. E. O'Riley gives of the Indigofera from the Tenasserim Coast, I suppose it is a superior plant to what is cultivated in Bengal, as the latter never grows to the size Mr. O'Riley states. I would therefore suggest, that some arrangements be made to obtain a supply of indigo seed from Egypt and the Tenasserim Coast; for whilst a material improvement has taken place in the culture of sugar-cane and other staples, by the introduction of superior seeds and plants from foreign parts, it is to be regretted, that a plant that yields such a valuable and important staple as indigo, has been so entirely neglected.

The Mauritius sweet potatoe, and Chota Nagpore white potatoe, are in a flourishing state. I shall next year, not only be able to plant out a large spot of ground, but I shall have sufficient cuttings to distribute. The red sweet potatoe is extensively cultivated in this district, but it is an inferior species.

The Tenasserim yam, Morus multicaulis and Pandanus vacoa plants, are doing well. A yam similar to the Tenasserim species you sent me, is extensively cultivated here: when the yams come to perfection, I shall be able to ascertain if there exists any material difference.

The seeds of the white gram from the South of Europe, maize and tobacco seeds of sorts, and dhalia seed, you were kind enough to send me, proved a failure, not a single grain vegetating; only a few plants of guinea grass vegetated.

The Chota Nagpore paddy, vegetated very freely, but the weather proving unfavorable on account of want of rain to transplant, the result was indifferent.

The arrow-root bulbs reached me in a decomposed state: this staple thrives remarkably well in Rungpore, and I have some growing in my garden at present, and in due course, I shall not fail to send down a specimen of the produce for your inspection.

I have made some experiments with the liberal supply of guano I received from you, and sugar-canes; but as I intend to make further

experiments on plants and vegetables, I shall reserve, whatever I have to communicate to you on this head, to a future opportunity.

I had inadvertently omitted to mention above, that I have met with a tree yielding a blue dye, growing in the garden of an old resident here, which, to judge from the description given in Mr. C. B. Taylor's letter, published in the Society's Journal, is the "Nerium tinctorium." I have not been able to obtain any particulars regarding the place whence the seeds were obtained. By the next boat opportunity that offers, I shall transmit to Dr. Wallich a branch of the tree, to ascertain if it is the Nerium tinctorium or not.

I am most thankful to you for your promise of a further supply of white linseed and wheat, which you have received from the Nerbudda, as well as plants and seeds of indigo-giving plants from the Tenasserim Coast, as also bamboo seeds; and I need not say, that all attention shall be bestowed upon them, and the result of the experiments reported to you in due course.

Chandamaree; 29th January, 1846.

Accordiug to promise, I have herewith the pleasure of submitting the following account of experiments, made by me, with the liberal supply of seeds received from you in November.

* *English Wheats and Barley.*—I regret to say, that the seeds although apparently fresh, did not prove so. They were sown immediately on receipt, but only a few grains vegetated.

Nerbudda Wheats.—Vegetated freely, and although a good many of the plants in appearing above ground were destroyed by birds, they are in a florishing state now, and have attracted the attention of all ryotts in this vicinity. In due course, I shall not fail to send you a specimen of the produce.

White Linseed from Nerbudda.—Vegetated freely, and is thriving most luxuriantly, and at present in full blossom. I shall in due course, transmit a specimen.

* *Egyptian Lentil Tares.*—Proved a failure, only a few grains vegetated; and they do not appear to thrive.

* *Tares.*—Same results as above.

* The seeds thus marked were received from the Court of Directors.

* *Rape.*—Vegetated freely, and at one time appeared to thrive remarkably well, but of late, the growth appears to have been stunted, and owing to the lateness of the season, I expect but an indifferent result.

* *Hemp.*—Proved a total failure, not a single grain vegetating.

* *Flax.*—Same result.

* *White Mustard.*—Vegetated freely, but owing to the lateness of the season, I do not expect the result to turn out so favorable, as if it had been sown earlier.

* *Turnips of three sorts.*—Vegetated and have turned out well.

* *Carrots of two sorts.*—Proved a total failure.

* *Mangul-Wurzel.*—Vegetated, and I expect a favorable result.

* *Clover.*—Vegetated, and is at present in a florishing state.

American Garden and Flower Seeds.—Proved to be very fresh, and it is only to be regretted, that they did not arrive in time.

English Garden seeds.—Proved also very fresh, in fact, I have never seen English seeds vegetate so freely.*

Cape Garden seeds.—Did not prove so fresh as last year.

Lucknow and Bauglepore Garden seeds.—Vegetated freely, but proved a failure; for they have that fault in common with all vegetable seeds raised in a hot climate, that the plant runs up to seed before it can come to perfection.

I have noticed Mr. G. J. Fischer's letter, and the information he gives regarding the Nerium tinctorium; although it shews that the plant is totally unfit to be introduced into the plains of Bengal for the sake of the dye, it would prove very interesting, if Mr. Fischer could give some particulars as to the mode and cost of manufacturing, —proportion of produce obtained from the leaves,—and a description of the works necessary for the manufacture of the dye. Such an account will, I have no doubt, prove very useful, and attract the attention of speculators.†

* These seeds formed portion of an assortment sent by Dr. Royle to the Society; and received by the October Mail.—Eds.

† This account has since been furnished. See page 9.

RESULT OF TRIALS GIVEN TO VARIOUS SEEDS AT RAMNUGGUR FACTORY, CHAMPARUN DISTRICT. COMMUNICATED BY J. W. YULE, ESQ.

To J. HUME, ESQ., *Secretary to the Agri-Horticultural Society of Calcutta.*

DEAR SIR,—I beg to apologize, for not having sooner acknowledged the receipt of the large supply of seeds, &c. you have, from time to time, so kindly sent me.

The first, consisting of English vegetable and flower seeds, reached me in October; but I am sorry to say, that the former did not vegetate well, and of the latter, the mignonette alone came above ground.

In December, I received the English cereal and other grains [presented to the Society by the Court of Directors], the Nerbuddah wheat and white linseed, and the American flower and vegetable seeds.

Of the first mentioned, I regret to report, nearly a total failure;* for, with the exception of the rape, clover, mangul-wurzel, and a few tares, not another seed vegetated, although all arrived apparently in the most perfect order, and every care was taken by me, to give the whole a fair trial, by sowing in a variety of soils having more or less moisture.

The Nerbudda wheat and linseed, however, succeeded admirably, notwithstanding the lateness of the season, and are at present most luxuriant, and promise to yield abundantly.

The American seeds have likewise all vegetated † and come to maturity in a wonderfully short space of time. The vegetables, especially the white turnip and red beet, are the best flavored I have ever met with in the country, being moreover quite free from fibre, of itself a great advantage.

The flowers, although the assortment does not seem to consist of any thing very rare, are most luxuriant, the hearts-ease being particularly rich in variety and color.

I cannot help contrasting this result with that from the English imported seeds, and conclude, that either more care has been taken

* This account, unfortunately, coincides with reports from other parts of the country.—EDS.

† The Society has received similar accounts from many quarters, proving the adaptation of American seeds to our Indian soil and climate.—EDS.

in the packing of the former, or that the temperature of America approaching nearer to that of India, seeds from that part of the world are better adapted to our climate, than those from England. Would it not then be advisable to procure from thence, a large supply of the rarer sorts of flower seeds, and of vegetables too, since both seem to succeed so well?*

The Otaheite canes, did not reach me until late in December, and I am sorry to add, in wretched condition, owing, I suppose, to the length of time they were on the way up: although few only seemed fit for planting, I put the whole into the ground, and to the present, about a dozen of strong healthy shoots have made their appearance.

The Sumach and Nerium tinctorium plants continue to thrive, but not a single madder seed has vegetated.

Ramnuggur; I remain, &c.
7th March, 1846. J. W. YULE.

RESULT OF TRIALS GIVEN TO VARIOUS SEEDS AT SEETAPORE.

Extract of a letter from DR. A. GREIG,—*dated Seetapore; March 22d,* 1846.

"I write this to give you some account of the quality of the Society's seeds this year, as far as the out-turn in my garden can show. The American seeds have come up beautifully without the failure of a single packet. However, I think, the seedsmen there, might include a greater variety, for instance some of the best *early* varieties of carrot, beet, &c. &c., and a more select variety of flower seeds.

"The Cape seeds have also all come up, but the quality of the produce is rather inferior. The supply as to varieties by Messrs. Villet and Co. is also scanty.

"I regret to say, that the English cereal grains all failed. They were sown under my own eye in very good ground, that had been most carefully prepared for their reception. The madder seed also failed."

* This suggestion has been anticipated. See report of Garden Committee, published in the proceedings for Dec. 1845.—EDS.

ACCOUNT OF AN EXHIBITION OF VEGETABLES AND FLOWERS HELD AT CUTTACK, IN DECEMBER, 1845. COMMUNICATED BY T. B. MACTIER, ESQ., C.S., SECRETARY BRANCH SOCIETY OF CUTTACK.

DEAR SIR,—The appointment of Captain Dunlop to the "Park Company" having rendered it necessary for him to relinquish the care of the Cuttack Botanical Garden, he requested me to take charge of it, until some preferable arrangement could be made. I have therefore the pleasure, herewith, to transmit an account of our first vegetable and flower show. Late rains destroyed the plants in many of the gardens, and rendered the number of competitions small. The whole of the vegetables (but more particularly the knol-kole) however, were, considering the season, very good. Among the flowers, the most rare, and I think most beautiful, was a plant of the "Portulaca grandiflora" in full flower, raised from American seed sent by the Parent Society.

Dahlias (Neilgherry and Cuttack seed) and sweet pea, were also sent; the former, however, wanted the compactness observable in the flower in England.

Captain Dunlop, previous to his departure, directed my attention especially to the Sumach and Cordia Sebestena: the former has been planted out, and though at one time he feared that the white-ants had attacked it, the plants look healthy, and have reached in some instances the height of four feet. Of the Cordia Sebestena we have two plants,* the seed was sown shortly after their receipt in April, and the plants are now upwards of six feet high, covered to within a foot of the ground with leaves about the size of a hand: there is, as yet, no appearance of blossom. The American flower seed sent by the Society has, in every instance, come up.

We have been obliged, by the withdrawal of the labor of the prisoners formerly allowed, to relinquish the cultivation of Cotton, but I hope soon to be able to commence again. As I see by your correspondence with Captain Dunlop, that a packet of cauliflower seed was last year sent you, I will, should you wish it, do myself the pleasure of forwarding some this year.

Cuttack; I am, &c.

December 26th, 1845. T. B. MACTIER,

Secy. of Cuttack Horticultural Society.

* The seeds from which these plants have been raised, were presented to the Parent Society, by B. J. Colvin, Esq., in January 1845. Plants, raised from the same batch of seeds, in the Society's Nursery garden and in Sir L. Peel's garden, have flowered well.—EDS.

CAULIFLOWERS, ...	Mr. Templer's Mallee, (Cuttack seed).
PEAS, ...	Ditto ditto.
KNOL-KOLE, ...	Mr. Lacey's ditto.
LETTUCE, ...	Mr. Mactier's ditto.
CABBAGE, ...	Ditto ditto.
TURNIP, ...	Ditto ditto.
BEET ROOT, ...	Ditto ditto.
CARROTS, ...	Mr. Mill's ditto.
ONIONS, ...	Mr. Mactier's ditto.
RADISHES, ...	Mr. Mill's ditto.
1ST BOUQUET, ...	Ditto ditto.
2D DITTO, ...	Mr. Mactier's ditto. Mr. Lacey's ditto.

Intimation was given that the above prizes would be awarded, on the day of the Show; the under-mentioned were added:—

2D CABBAGE, ...	Col. Garnault's Mallee.
DITTO TURNIPS,	Mr. Mill's ditto.
CELERY, ...	Ditto ditto.
AMERICAN SQUASH,	Ditto ditto.
PINE, ...	Col. Garnault's ditto.
LOVE APPLE, ...	Mr. Mill's ditto.
CUSTARD APPLE,	Mr. Mactier's ditto.
BEANS, ...	Mr. Lacey's ditto.

The Medals presented by the Parent Society were reserved for a future occasion.

REPORT OF AN EXHIBITION OF VEGETABLES AND FLOWERS, HELD BY THE BHAUGULPORE BRANCH AGRI-HORTI. AND FLORICULTURAL SOCIETY.

Communicated by MAJOR T. E. A. NAPLETON, *Secretary of the Society.*

An exhibition of flowers and vegetables, took place on Friday evening, the 30th of January, 1846, and was attended by a great number of European and Native subscribers, as well as visitors. The flower show was held in the Society's new show room, and the baskets of vegetables were laid out in rows, under a mangoe grove, where a fine raised circular platform, and branch walks, were nicely prepared for their reception. Umpires for the vegetable department, consisting of R. Barnes, Esq., Rev. J. MacCallum, E. Gouldsbury, Esq., and Charles Quintin, Esq., were

then elected, and kindly consented to execute the duties pertaining thereto. During the competition for prizes, the assemblage of respectable natives increased to such an extent (estimated at not less than ten thousand,) that the walks between the vegetable and flower shows, presented one dense living mass.

Amongst the many private *dallees* brought forward for competition, the finest specimens of vegetables, consisted of Cherra Poonjee and Darjeeling potatoes, vegetable marrow, Botan and English turnips, splendid beet root, and mangul-wurzul, peas, late cauliflowers, cabbage of three sorts, love apples, Windsor beans, superb lettuce and endive, tolerable celery, fine nohl-kohl, carrots, English and Country, arrow-root, Cabool onions, and Cabool capsicums, horse-radish, *cum multis aliis;* and in awarding the prizes for the foregoing (amounting to about 45 Rs.) great judgment was displayed by the umpires, whose decision seemed to give general satisfaction,

The *mallees* of the following gardens carried off prizes :—

James Pontet, Esq.—For cabbages, turnips, leeks, herbs, late cauliflower, artichokes and carrots.

G. Barnes, Esq.—For Darjeeling potatoes, Cabool capsicums, lettuce, and Windsor beans.

G. F. Brown, Esq.—For Darjeeling potatoes, celery, onions, and Windsor beans.

Cleveland House.—For cabbages, Darjeeling and Cherra Poonjee potatoes, nohl-kohl, carrots, onions, love-apples, late cauliflower, a superb specimen.

Captain W. G. Don.—For celery and leeks.

John Glas, Esq.—For nohl-kohl, arrow-root and radish.

C. D. Russell, Esq.—For peas, turnips and vegetable marrow.

The mallees of Baboo Gooroo Churun Mitter, Muddun Tackoor, Ubdollah Khan, Mahomed Majid Khan, Mahomed Rafig, and Baboo Oomanauth Ghose, carried several prizes for European and indigenous vegetables.

The produce of the public garden was now inspected by the umpires, which consisted of about thirty baskets of remarkably fine vegetables, and the following is the opinion recorded by the umpires :—

"We are of opinion, that the show of vegetables and flowers, exhibited this day in the public garden, excelled it is believed, any thing of the kind ever seen in India, and would vie with the best productions of Covent Garden, in point of size and quality, as will be proved by the weight of the articles specified below; reflecting the greatest credit on Major Napleton, the Honorary Secretary, for his zeal and skill in pro-

ducing such a magnificent show of first rate vegetables, flowers and exotics, from what was a short time since, a common indigo field.

"The taste and skill, also displayed, in laying out the garden, and the fine order in which it is kept, is beyond all praise, and excited the admiration of the thousands assembled to view it. It is hoped that this laudable example will be followed at every station in India."

(Signed) C. W. Quintin,
,, R. Barnes,
,, J. MacCallum,
,, F. Gouldsbury.

Memorandum.

Showing the weight (80 Siccas to the seer) of some of the public garden vegetables.

Celery.

One stick weighed 3lbs. 10 ounces, and was finely bleached.

Another stick weighed 2lbs. 10 ounces, and was finely bleached.

The oldest residents in India, present at the show, were unanimous in declaring the celery exhibited, to be far the finest ever seen by them in India, and perhaps never surpassed in Europe.

Cabbage.

One drumhead cabbage weighed 12lbs., but had not attained its full growth.

Beet-root.

Two pieces of beet-root, weighed 4lbs. 11 ounces.

Potatoes.

Four potatoes from Cherra Poonjee seed, weighed 3lbs.; and it has been most satisfactorily ascertained, that the Cherra potatoe is superior in flavor, and more productive, than any other grown in India, with exception of the Darjeeling, which, after being acclimated at Bhaugulpore, is a wonderfully good potatoe, with a skin as fine as silk, and in color delicately white.

Onions.

Four onions from acclimated Cabool seed, weighed 3lbs. and 5 ounces, and were beautifully white in color.

Nohl-kohl of enormous size, was amongst the specimens; also some baskets of fine West India arrow-root, Windsor beans, Darjeeling potatoes, turnip-cabbage, turnip-radish, endive, lettuce, Savoy cabbage, superb carrots and turnips, &c. &c.

A month's pay was awarded to the public garden mallees as follows, for their unceasing exertions in their respective departments :—

Seebchurn, head mallee in Floricultural department,	...	7	0	0
Gonur, head mallee in Agri-Horticultural department,	...	6	0	0
Toofanee, head malee in Vegetable department,... ...	...	6	0	0

Floricultural Department.

The Flower Show (Mr. Russell, Mr. Young, and G. F. Brown, Esq. having most obligingly undertaken the duty of umpires) presented a most gay and animated appearance. The following exotics from the garden of R. F. Hodgson, Esq., Civil Service, Monghyr, were much admired, and three prizes were awarded to that gentleman's mallee :—

Schizanthus laciniata, Lasthenia californica, Centaurea aurea, Narcissus, Hyacinth, Cheiranthus, Mathiola, Commelina ionosma, Iberis odorata, Mesembryanthemum glabrum, Gypsophila, Silene corioides, Solanum pentapetaloides, Calandrinia grandiflora.

The bouquets from the public garden were rich and beautiful. The Tecoma jasminoides, Ipomea rubra cærulea, verbena, poinsettia, stocks, gillardia picta, geraniums of sorts, Bussorah and other roses, heliotrope in the greatest profusion, laburnum, sweet-william, wall-flower, passion flowers, aristhoma, double pinks, a beautiful large double white China rose, with many others.

From the garden of C. D. Russell, Esq. a fine specimen of heart's-ease, also of blue lupin, for which a prize was awarded.

From Cleveland House garden, some beautiful specimens of white and pink Bussorah roses, verbena, heliotrope, passion flowers, sweet-william, myrtle, sweet-brier, stock, narcissus, &c., were exhibited, and several prizes awarded.

From Captain W. G. Don's garden, a fine show of geraniums, zinnias, heliotrope, Cape laburnum, &c., were brought, and some prizes awarded.

From Mr. G. F. Brown's garden, there were specimens of heliotrope Cape laburnum, zinnias, mignonette, &c., and some prizes were awarded.

From Sergeant Dowling's garden, there were some very fine geraniums, euphorbia flowers, and a basket of splendid Cabool capsicums, for which prizes were given.

Some prizes were also awarded to the mallees of Muddun Tackoor,

Ubdoollah Khan, and Baboo Oomanauth Ghose, for bouquets of indigenous and other flowers.

The umpires exhibited much good taste and floricultural knowledge, in the awarding of prizes, aud were pleased to pronounce this Flower Show, the best which has ever taken place in the Society's Garden.

Having noticed the Horticultural and Floricultural departments, it now becomes a pleasing duty to report, that a new *Surae* (or travellers' inn) adjacent to the Society's Garden, commenced in November last hy Mr. J. H. Young of the Civil Service, was opened on this occasion. It consists of two handsome ranges of tiled huildings; the houses facing inwards, being for the accomodation of travellers; and those facing outwards, for all sorts of merchants' shops. Thousands of people were assembled to witness the opening of this desirable and useful undertaking. Ahout forty travellers took up their abode in the *Surae* this evening, and a great number of ladies and gentlemen of the station, honored with their presence this truly gratifying scene.

Between the public garden and the *Surae* is a splendid tank of water with three *pucka* ghats attached to it. The chief of which is a most chaste and beautiful structure, the design of Mr. J. H. Young, and which did not fail to call forth the praise and admiration of thousands. There was also a public market opened on this occasion, in a mangoe tope near the tank, and is to be held in future twice a week.

It is with great pleasure we report the names of the following new Subscribers since the 23d November last:—

H. W. Beddy, Esq., of Chicheroon near Bhaugulpore.

W. H. Brodhurst, Esq., Civil Service, Bhaugulpore.

Baboo Nocoor Chundur Chowdry Roy, Bhaugulpore.

T. Young, Esq., Civil Service, Monghyr.

Baboo Bishashur Narain, a large Zumeendar of Monghyr.

T. Taylor, Esq., Civil Servicc, Rampore Bauleah.

Baboo Bridjoo Oipudkea, a large Zumeendar of Gyah.

R. King, Esq., Deputy Opium Agent, Patna.

Major M. Lawrence, late resideut of Kutmandoo, and now Governor General's Agent, N. W. Provinces.

W. S. Kelly, Esq., of the Firm of Messrs. Owen Alhusen and Co, Calcutta.

Robert H. Irvine, Esq., M. D.

Baboo Muddun Mohun Sing, a large Zumcendar of Tirhoot.

Baboo Mohis Chundur Bosc, a large Zumeeudar in the Bhaugulpore district.

List of donations since the 23d of November last.

From E. F. Lautour, Esq., Civil Service, Gyah,—a donation of twenty-five rupees.

From Dr. Wallich, Superintendent Honorable Company's Botanical Gardens,—many rare and beautiful plants, accompanied by his anxious wish to continue his aid in promoting the best interests of our floricultural department.

From the Honorable Sir L. Peel,—a great many of the beautiful plants received from time to time, from our early patron, Sir L. Peel, are now most conspicuous in our public garden; particularly some plants of the Ipomea rubra cærulea, which are in full and rich flower, and thousands of people stop to gaze on and admire these lovely specimens of the beauties of Flora.

From John Hamilton, Esq.,—some precious plants of the passiflora family, and a variety of other rare and most acceptable plants, from his beautiful garden at Balleygunge.

From Captain Munro of H. M. 39th Regiment,—two beautifully executed paintings of the flowers of the *seemul*, or Bombax malbaricum and the Gossypium religiosum. This kind donation was, by mistake, omitted in our last report.

From C. D. Russell, Esq.,—a number of choice plants are constantly arriving from Mr. Russell's garden, who has the welfare of our public garden at heart.

From Captain Hockley, Commander of the Jellinghce,—a basket of English potatoes received in the finest order for planting, also some plantain shoots of rare sorts.

From C. K. Robison, Esq.,—a handsome present of a box of Malacca fruit trees.

From——Wood, Esq., of Calcutta,—ten very choice plants from his beautiful garden, which have greatly enriched our stock of exotics.

From Captain W. G. Don,—a number of geraniums, ixora, heliotrope, euphorbia and russelia plants.

From Cleveland House garden,—several hundreds of plants of fine sorts, and a hundred Bombay mangoe grafts.

For all these handsome gifts, the best thanks and acknowledgments of our Branch Society are proffered for the acceptance of the donors.

By order of the Garden Committee.

T. E. A. Napleton,

Honorary Secretary, Bhaugulpore B. A. H. & F. Society.

ACCOUNT OF AN EXHIBITION OF FLOWERS, FRUITS, AND VEGETABLES, HELD AT LUCKNOW IN MARCH, 1846. COMMUNICATED BY THE REV. DR. CARSHORE, ACTING SECRETARY OF THE AGRI-HORTICULTURAL SOCIETY OF LUCKNOW.

To JAMES HUME, ESQ., *&c. &c. &c.*

MY DEAR SIR,—I have much pleasure in forwarding a list of the flowers, fruits, and vegetables, for which prizes were awarded at our exhibition, which was held on the 17th ultimo. You should have had the list before; bnt business and sickness prevented me.

May I beg the favor of your letting me have a package of your acclimated vegetable seeds. They are, I find, best suited for early sowings.

Lucknow; March, 17th. Yours faithfully,

J. J. CARSHORE.

Prizes awarded for Flowers, Fruits, and Vegetables, at the exhibition held at Lucknow on the 17th February, 1846.

Names of Flowers, Fruits, and Vegetables.	Names of Malees to whom the prizes were awarded.	Names of the Person in whose service the Malees are.	Amount of Prizes.		
FLOWERS.					
Violet,	Soobha,	Colonel R. Wilcox,	1	0	0
Heart's-ease, darkest,	Munsa,	Char Bagh, 2d Division,	1	0	0
Heart's-ease, largest,	Budloo,	Mrs. Scott,	1	0	0
Geranium, new varieties,	Gunga,	R. W. Bird, Esq.,	2	0	0
Geranium, darkest,	Budloo,	Mrs. Scott,	1	0	0
Geranium, largest,	Munsa,	Char Bagh 2d Division,	1	0	0
Sweet-william,	Bhola,	Brigadier Webber,	1	0	0
Double stock,	Goorbukhsh,	Rev. Dr. J. J. Carshore,	1	0	0
Larkspur,	Bhola,	Brigadier Webber,	0	4	0
Coreopsis,	Bukha,	Dr. Woodburn,	0	4	0
Nasturtium,	Bhakaree,	Dr. Login,	1	0	0
Double wall-flower,	Bhola,	Brigadier Webber,	1	0	0
Lupin,	Heera,	Mrs. Davidson,	0	4	0
Zinnia,	Munsa,	Char Bagh, 2d Division,	0	4	0
Indian pink,	Bhola,	Brigadier Webber,	1	0	0
Iris,	Jankee,	Mrs. Davidson,	1	0	0
Best bouquet of flowers,	Bukha,	Dr. Woodburn,	5	0	0
FRUITS.					
Strawberry,	Nannoo,	Char Bagh, 1st Divison,	1	0	0
Strawberry,	Soobha,	Colonel R. Wilcox,	1	0	0
Gooseberry,	Sukkut,	Captain Cooper,	0	8	0
Pumplenose,	Bhola,	R. W. Bird, Esq.,	0	8	0
Citron,	Munsa,	Char Bagh, 2d Division,	0	4	0
Kurna,	Gunga,	R. W. Bird, Esq,	0	4	0
Orange,	Heera,	Mrs. Davidson,	1	0	0
Lime (Cagzee,)	Goorbukhsh,	Rev. Dr. J. J. Carshore,	0	8	0
Sweet lime,	Heera,	Mrs. Davidson,	0	4	0
Plum,	Munsa,	Char Bagh, 2d Division,	0	4	0
Plantain,	Nannoo,	Ditto ditto, 1st ditto,	0	4	0
Loquat,	Ditto,	Ditto ditto, 1st ditto,	0	4	0
		Carried over,	25	0	0

Names of Flowers, Fruits, and Vegetables.	Names of Malees to whom the prizes were awarded.	Names of the Person in whose service the Malees are.	Amount of Prizes.		
VEGETABLES.		Brought over,..	25	0	0
Cauliflower,..............	Sobha, ...	Colonel R. Wilcox.....	2	0	0
Broccoli.	Goorbukhsh, ...	Rev. Dr. J. J. Carshore,	2	0	0
Cabbage,................	Dial, ...	Mrs. Davidson, ...	1	0	0
Knole Khole, above ground,	Bachoo, ...	Captain Drake, ...	0	8	0
Knole Khole, under ground,	Goorbukhsh, ...	Rev. Dr. J. J. Carshore,	0	8	0
Pea, the greatest variety,	Goorbukhsh, ...	Ditto ditto, ...	1	0	0
Pea, the largest, ...	Sukkut, ...	Captain Cooper,........	1	0	0
Bean..................	Goorbukhsh, ...	Rev. Dr. J. J. Carshore,	1	0	0
French Bean, ...	Ditto, ...	Ditto ditto,............	2	0	0
Potatoe, bangor, ...	Sobha, ...	Colonel R. Wilcox, ..	1	0	0
Potatoe, apple, ...	Dial, ...	Mrs. Davidson,........	1	0	0
Yam,..................	Nannoo,........	Char Bagh, 1st Division,	0	4	0
Jerusalem Artichoke, ...	Gunga, ...	R. W. Bird, Esq.,......	0	4	0
Turnip, finest Maltese & greatest variety,..	Goorbukhsh, ...	Rev. Dr. J. J. Carshore	1	0	0
Turnip, finest stone,	Sobha, ...	Colonel R. Wilcox, ..	0	12	0
Carrot, long orange,....	Munsa, ...	Char Bagh, 2d Division	1	0	0
Carrot, early horn, ...	Goorbukhsh, ...	Rev. Dr. J. J. Carshore	0	8	0
Carrot, white, ...	Ditto, ...	Ditto ditto,...........	0	8	0
Parsnip, (the first season exhibited,).	Dhurrum Doss,.	Mrs. Davidson,.......	5	0	0
Red beet, ...	Bhakaree, ...	Ditto ditto,	0	12	0
White beet, ..	Goorbukhsh, ...	Rev. Dr. J. J. Carshore	0	4	0
Salsify,.......	Munsa, ...	Char Bagh, 2d Division	0	4	0
Radish,.......	Heerah,	Mrs. Davidson, ...	0	4	0
Onion,.......	Sobha, ...	Colonel R. Wilcox.	0	4	0
Leek,......	Goorbukhsh, .	Rev. Dr. J. J. Carshore,	0	4	0
Spinage, green smooth leaved,....	Goorbukhsh, .	Ditto ditto,	0	4	0
Spinage, prickly leaved,	Munsa,	Char Bagh, 2d Division.	0	4	0
Squash..................	Nannoo,...	Ditto ditto, 1st ditto. ...	0	4	0
Artichoke,..............	Ditto, ...	Ditto ditto, 1st ditto,....	0	8	0
Tomato,................	Dial, ...	Mrs. Davids.	0	4	0
Capsicum,..............	Munsa,..........	Char Bagh, 2d Division,	0	4	0
Chilly, ...	Meeheelall, ...	Nawab Meean Nickrose Ally,....	0	4	0
Sweet Potatoe,..........	Ditto, ...	Ditto, ...	0	4	0
Brinjal,................	Goorbukhsh, ...	Rev. Dr. J. J. Carshore,	0	2	0
Celery, ...	Ditto, ...	Ditto,	3	0	0
Lettuce,................	Jankee, ...	Mrs. Davidson,	0	4	0
Endive,................	Nannoo, .	Char Bagh, 1st Division,	0	4	0
Sugar-cane, ...	Gunga, ...	R. W. Bird, Esq.,......	0	8	0
		Total, Co's. Rs.	55	10	0

J. J. CARSHORE, D. D.

Acting Secretary.

ACCOUNT OF THE ANNUAL EXHIBITION OF VEGETABLES AND FRUITS, HELD AT HOOGHLY IN JANUARY, 1846. COMMUNICATED BY THE REV. C. W. CAHUSAC, ACTING SECRETARY, BRANCH AGRI-HORTICULTURAL SOCIETY OF HOOGLY.

To JAMES HUME, ESQ., *Secretary to the Agricultural Society.*

DEAR SIR,—I have now great pleasure in forwarding you a statement of the annual fruit and vegetable show, held at Hooghly in last Janurry. It was sent to me by Rajkissen Morkerjea, and was, I conclude, drawn up by his brother, who is our Native Seeretary.

Chinsurah; I remain, &c.,
March 26th, 1846. C. W. CAHUSAC.

Branch Agricultural and Horticultural Society at Hooghly.

The annual exhibition of flowers and vegetables took place in the Circuit House, on the 19th January, 1846. A respectable number of ladies and gentlemen was present on the occasion, among whom were F. W. Russell, Esq., President of the Society, S. Wauchope, Esq., G. Herklots, Esq., Rev. C. W. Cahusac, Rev. James Bradbury, and Roy Radha Govind Baboo.

The show was altogether satisfactory, and considering that almost every part of the district, was only a few months back, completely inundated, reflected the highest credit on the skill and perseverance of the *malees.* The potatoes, celery and lettuce in particular, attracted great notice, and were pronounced by competent judges, far superior to any thing of the kind ever seen in the district, and fully equal to what has yet been produced in other parts, known as peculiarly favorable to their cultivation.

The Society's Nursery Garden is doing remarkably well; that portion of it, reserved for the purpose of rearing up vegetables, peas, &c., both indigenous and exotic, presents at this day, a very healthful appearance; more than one-third of it has moreover been tastefully laid out in flower-beds, which offer no ordinary attraction to the gentlemen of the station.

The following is a list of the prizes distributed:—

Mothoor Doss Malee, ...	For Potatoes, ...	*1 Silver Medal.			
Horronath Malee,... ...	,, Foreign sugar-cane,	*1 Ditto ditto.			
Goluk Malee, ...	,, Peas, ...	5	0	0	Co's. Rs.
Sagore Malee, ...	,, Sugar-loaf cabbage,	5	0	0	

* These Medals were presented by the Parent Society, in addition to an annual grant of 50 rupees.—EDS.

Bungshee Malee, ...	For Cauliflower, ...	5	0	0	Co's. Rs.
Tittoo Malee, ...	,, Carrots, ...	5	0	0	
Ramdhone Malee, ...	,, Nohl-kohl, ...	5	0	0	
Obhoy Malee, ...	,, Turnips, ...	5	0	0	
Monohur Malee, ...	,, Beet, ...	5	0	0	
Kassinath Malee, ...	,, Lettuce, ...	5	0	0	
Monohur Malee, ...	,, { A dalee of different kinds of vegetables, }	5	0	0	
Soobol Malee, ...	,, Cauliflower, 2d prize,	2	8	0	
Lal Chund Malee, ...	,, Cabbage,... 2d ditto.	2	8	0	
	By W. F. RUSSELL, ESQ.				
Sagore Malee, ...	For Celery, ...	5	0	0	
	By S. WAUCHOPE, ESQ.				
Modun Malee, ...	For Peas, ... 2d prize,	3	0	0	
Ruggonath Malee, ...	,, Carrots, ... 2d ditto,	3	0	0	
	By REV. C. W. CAHUSAC.				
Bungshee Malee, ...	For Potatoes, ... 2d prize,	4	0	0	
	By REV. J. BRADBURY.				
Ruggohath Malee, ...	For a dalee, ... 2d prize,	4	0	0	

MALAYAN GUANO ("TY BURONG.")

By DR. CANTOR, *Civil Surgeon, Prince of Wales' Island.*

Mr. E. Solly read, before the Chemical section of the British Association at Cambridge, the following paper on Guano, by Dr. Cantor, which he had received from Dr. Royle, of the East India House :—

Denomination.—Ty Burong,* in the Malayan language, signifies birds' manure, but not every substance thus denominated is obtained from birds ; for bats are considered by the Malays to be birds, and, although the different kinds are distinguished by separate names, their manure is included in the general denomination of Ty Burong.

Use of Manure among the Malays.—Before noticing the different kinds of birds' and bats' manure, it is as well to observe that the use of manure is, according to Mr. Crawfurd, not adopted by the inhabitants of the Indian Archipelago. In the chapter devoted to general remarks on the husbandry of the Indian Islands, Mr. Crawfurd observes upon this head, "The fertilizing process of irrigation almost supersedes the use of other dressings, or, at least, causes them to be neglected. None of the Indian islanders ever apply any

* *Ty*, offal, dross, manure ; *Burong*, bird.

kind of manure directly to the land. In process of time, when the Rice-lands are exhausted and the poorer lands are in more request, dressings will be applied to the upland soils, and the refinements of agriculture will approximate them more nearly in value to the lands capable of submersion." Though no dressings be applied directly to the land, some processes are pursued which, to a certain degree, are equivalent to them. In reaping the principal crops, particularly the Rice crop, the best part of the straw is left on the ground, and into this ample stubble (the village) cattle are turned, until it be exhausted. During the short period during which the land is permitted to lie fallow, the cattle are constantly fed in the Rice grounds, and as the dung is not removed for the purpose of fuel, as among the people of Hindustan, the land benefits by this accidental dressing. To this it must be added, that, immediately before ploughing, the whole of the remaining stubble and dry weeds are systematically burnt on the ground, and the carbonaceous refuse spread on the land as a manure. It may be presumed, that experience has ratified the utility of a practice which is general, and which is, in some respects, parallel to that of paring and burning among our agriculturists."—*History of the Indian Archipelago*, vol. i. p. 354.

Throughout the Malayan Peninsula the application of manure is very limited. In the cultivation of Rice and Tobacco, birds' manure has, from time immemorial, been in use among the inhabitants of Kéddah (Quédah), and the tributary territory of Purlis. In the latter locality, the supply of birds' manure is principally obtained from Bukit Jubing, situated about 7 miles to the northward of Karngha, the residence of the chief of Purlis, while the agriculturists along the coast are supplied from the islands in the vicinity, particularly from Pulo Karap, situated about a mile from the mouth of the Purlis River. In Kéddah the manure is procured from inland mountains (Gunong, Geriang, and Bukit Khopuloh, in particular), from which circumstance it appears most likely to be bats' manure. The depôts of the latter kind are, however, resorted to for another purpose, which is more general, viz.,—that of obtaining saltpetre for the home manufacture of gunpowder. The making, or rather gathering, of saltpetre is a royal prerogative, the infringement of which is, according to the Malayan code, a capital crime. The Malayan saltpetre is of very inferior description, and the inconsiderable quantity brought to market, commands a price but one-half of that manufactured in Bengal (which fetches in the Straits from 4 to 6 dollars per picul).

Birds' Manure.—Ty Burong, or guano properly speaking, is obtained from Hirundo esculenta, the swallow which makes the edible nests and feeds upon insects. It is a coarse, light-brown, or snuff-colored earthy powder, more or less mixed with undigested remains of insects (apparently large ants occasionally prevailing), and of a more or less strong taste of saltpetre, but without offensive smell. With a watery solution of carbonate of potash,

ammonia is developed; but to judge by the faint smell, but in small quantity. By exposure to the atmosphere (under a temperature of 75° to 80°), it attracts moisture in a considerable degree. From the fact of the manure being obtained from the swallow, whose nests form an article of considerable importance in commerce, the localities where to search, as well as the number of the depôts may be inferred. Such depôts of the manure of birds and bats occur on the myriads of rocky islands lining the coast of the Tenasserim provinces, from about the 15° north, continuing along the Malayan Peninsula, and terminating in the Indian Archipelago. In a tropical climate, where the moisture of the atmosphere combines to create great evaporation, the quality of the manure would suffer, or be lost, if it was not for the birds and bats selecting places of abode, sheltered from the influence of the weather and the sea. Probably in quality the manure must suffer withal, but the results of its application in the Malayan Peninsula and Prince of Wales' island are such as to prove its efficacy. The depôts from which it is taken exist in the extensive caves in the islands of limestone rocks, stretching, with intermissions, from Maulmain to Java. Although sea-birds inhabit many of the Malayan Islands in prodigious numbers, their abodes are too much exposed to the influence of the atmosphere and tides, to render the guano applicable, even though it was suffered to accumulate. But there is every reason to believe that the assertions of the Malays, that no such depôts exist in the Malayan Seas, are correct. The localities, which hitherto have supplied the agriculturists of Prince of Wales' Island with birds' manure, are principally Pulo Balitong, one of the Lancavy Islands; Pulo Mootiah, an island near the mouth of the Trang River; Pulo Beberee, near Pungah; and Cangam, not far from Mergui. A very extensive depôt is reported by the Malays to exist in Pulo Nepis, an island near the mouth of Pungah River, but from the impracticable nature of the entrance to the cave, it has not yet been resorted to. The depôts of the first-mentioned islands, which have been mentioned solely as known to supply the agriculturists of Prince of Wales' Island, are computed to contain a quantity of manure not less than 1000 coyans, or between 2000 and 3000 tons.

Bats' Manure.—The external appearance so greatly resembles that of the swallows, that it is scarcely possible by sight to distinguish the one from the other, and the difference must therefore be ascertained by chemical analysis. The criterion by which the agriculturists judge of the quantity, and fix the price of both kinds, is by applying a small quantity to the tip of the tongue. According to the stronger or weaker taste of nitre, they are guided in their choice and valuation, and this simple method appears to answer practical purposes. The Malays denominate the bat "Klawah" (Vespertilio——— ?) and the manure occurs sometimes under the name of "Ty Klawah." This bat (and probably other genera) inhabits the same localities as the swallows. There is a large depôt of bats' manure in Pulo Mootiah, from whence it has

frequently been imported to Prince of Wales' Island; but as this kind has been found of much less efficacious qualities than the swallows' manure, it is new in little demand among agriculturists, and if imported at all, it occurs mixed with birds' manure. Manure, obtained from a frugivorous bat, is reported to have been tried without beneficial results. The bat is commonly denominated the "flying fox"—"Klnwang" of tho Malays (Pleropus javanicus, Horsfield), which inhabits low jungles. Perhaps one of the largest companies is that frequenting the island of Callum, in the Straits of Malacca, separated from the Peninsula by a narrow shallow arm of the sea. The island, several miles in length, is but little elevated above high-water mark, and is covered by a dense, apparently impenetrable, Mangrove jungle. The passage through the Straits of Callum exhibits, at all times, a most singular spectacle. The trees, verdant below, present withered tops, suspended from whose naked branches the bats appear during the day like large black fruits. At sunset, when the countless masses sally forth, they may be said literally to darken the skies. The atmosphere, even at some distance from the island, is said to be tainted by the effluvia, but the manure, however plentiful, is too much exposed to the influence of the climate and the sea to expect it would answer agricultural purposes. Such, indeed, must, in these latitudes, be the case with the manure of all frugivorous bats, who take up their abodes in the branches of trees, but never in caves.

Application of Ty Burong.—Scarcely ten years have elapsed since the birds' manure was first introduced in Prince of Wales' Island, by some Chinese agriculturists, in the cultivation of Cocoanut trees. The success of the first experiments led to repetition, and the application has by degrees been extended to Nutmeg, Clove, and Sirih Vine (Piper siriboa) plantations and fruit trees in general. It has also been used to Sugar-cane, and successfully, as far as growth is concerned; but the Chinese planters assert, that cane thus manured, however fine in appearance, loses in saccharine matter, and have therefore discontinued the application to this branch of cultivation. Neither in Prince of Wales' Island, nor in Province Wellesley, has this kind of manure been tried in Rice cultivation. During the last five or six years, it has been applied by some of the European agriculturists in the different branches of cultivation mentioned in the preceding. Mr. Brown of Glugor, the owner of the most extensive plantations in the Straits Colonies, applies annually increasing quantities of Ty Burong. Likewise, Major Low, on his estates in Province Wellesley. Mr. Lewis, the Assistant Resident Councillor of Prince of Wales' Island, has, by way of experiment, tried some in the flower-garden of the Government House on the Great Hill (2,460 feet above the level of the sea), and the result is represented as having proved very successful. If applied unmixed and immediately, this manure, like the Peruvian guano, destroys vegetation. It has, therefore, been found necessary to mix it with what is here denominated "burnt earth," which

signifies rubbish of all sorts reduced by fire to ashes. In the proportion of the mixture of burnt earth and birds' manure, the agriculturist must of course be guided by a thorough knowledge of the nature of his soil and the subject of cultivation. The method followed in the cultivation of Nutmegs, will be perceived by the following, kindly supplied by Forbes Brown, Esq., of Glugor.

Memorandum.—Ty Burong, as manure to Nutmeg trees, has been applied in a variety of ways, and the manner of applying it, as well as the proportions, is still very different, in different plantations. I first tried it at Glugor, in 1838. It was applied to trees of about ten years of age, unmixed, and about twelve gantons per tree, spread over the roots. The result was most unfavorable; all the trees were more or less injured, and several were killed. After this, I did not try it again at Glugor for several years, but the Chinese manager of a plantation (Battu Lanchang Hill) in which I hold a half interest, recommended it in 1839, and had my permission to apply some to the trees in this plantation, which were then about nine years old. He applied it thus,—a trench of about eighteen inches, was dug all round the trees at the extremity of the roots, into which surface earth and grass was first put, and upon this layer was spread about sixteen gantons of Ty Burong, unmixed. The result in this instance was found very encouraging, and ever since the same mode of manuring has been continued in that plantation, the trees of which, considering their size and age, have been the most fruitful I have met with, and no manure except Ty Burong has been applied; to which, therefore, must be attributed the success. Some time after this favorable experiment, I was induced to give the manure another trial at Glugor, where I have applied it in different ways, both by itself and mixed with burnt earth and buffalo dung; and on the whole I have been well pleased with the results. The Chinese estimate the proportion as one to five, but I should think with good Ty Burong, that the difference ought to be greater. On the whole, I prefer using it mixed either with burnt earth or cattle manure (the latter more especially on the plains, where it can be easily procured), and my usual proportion is about eight of burnt earth, or cattle manure, or both mixed, to one of Ty Burong. The Chinese generally use it in the proportion of three to one. The quantity given depends much on the size of the tree. A trench of from eighteen to twenty-four inches in depth and breadth, is generally dug, in which earth, grass, and rubbish are first put; upon these is spread the mixture. One of our large trees would take about 400 gantons, and those of a medium age—say twelve or fifteen years old—about fifteen gantons; this I should expect to last some two to three years. Other European planters adopt proportions different from mine, but few follow the proportions used by the Chinese; and the use of this manure is still principally confined to the latter planters.

Glugor; Nov. 25th, 1844. (Signed) FORBES A. BROWN.

Price.—Tho importation of birds' manure in Prince of Wales' Island, has hitherto been in the hands of Chinese merchants, who receive the orders of the agriculturists; and accordingly during the N. E. monsoon, despatch largo junks to the well-known depôts. With the increased demand, the price has, during the last four or five years, nearly doubled. Mr. Forbes A. Brown, of Glugor, paid in 1840, 5 Sp. drs. (about 1*l.* 2*s.* 6*d.*) per coyan of 800 gantons (equal to ahout $2\frac{5}{6}$ tons). Tho price of that quantity is at present from $7\frac{1}{2}$ to 9 Sp. drs. (1*l.* 13*s.* 9*d.* to 2*l.* 0*s.* 6*d.*), or about 11*s.* 3*d.* to 13*s.* 6*d.* sterling por ton. According to the statement of Dr. Van Martius (Report upon guano), tho price in Peru of 238 lbs. of guano is from 5*s.* to 8*s.* sterling, which is about 2*l.* 2*s.* to 3*l.* 7*s.* per ton of 20 cwt. Should, therefore, future results create a demand for tho Malayan guano, tho price will greatly be in favor of the latter, which to the Indian agriculturist, offers the additional advantage of easy access. Tho annexed table of the present freights per ton, from Prince of Wales' Island to different ports, will afford somo estimate of the rates at which the commodity may be shipped.

From Prince of Wales' Island to	Freight per ton.			Prime cost added to Freight						
	£.	*s.*	*d.*	£.	*s.*	*d.*		£.	*s.*	*d.*
England and Sydney, ..	4	0	0	4	11	3	to	4	13	6
Calcutta and Madras,. .	1	0	0	1	11	3	„	1	13	6
Bombay, ...	1	5	0	1	16	3	„	1	18	6
Hong Kong,..............	2	0	0	2	11	3	„	2	18	6

To the above must be added all minor incidental charges.

The Malayan localities, where tho guano is found, are most accessible during the N. E. monsoon. The parties hitherto engaged in the importation to Prince of Wales' Island declare, that they are prepared to meet orders to any extent, and have, as yet, punctually executed those received. Should, however, the results of future experiments provo such, as to render the Malayan guano an object of desirable importance beyond tho Straits, a survey of tho depôts, and a report of their capability will be necessary.

Other Animal Manures.—The soil of the Prince of Wales' Island may, generally speaking, be said to bo light. That of the valley is alluvial; near the coast, the surface is a light vegetable mould, about four inches in depth, resting upon the sand, but gradually increasing in thickness and richness, as the country rises towards tho foot of the hills. Beds of whitish clay are interspersed throughout. Tho soil of the hills consists of disintegrated granite, forming with the decomposed vegetablo matter, a crust varying in depth, and frequently of reddish or rust color. The European spice-planters chiefly use cattle manure (buffaloes' and cows'), the cost of which may be estimated at 20 cents of a Spanish dollar, or about 10*d.*, for a rather small cart-load. It is not only much less efficacious, but far more bulky than birds' manure. The latter quality becomes a matter of consideration where

labor is expensive, and the manure has to be carried to a distance, particularly up-hill. A coolie will carry a basket on his head, whether the contents are light or heavy, no matter, he carries but a basketful. In the cultivation of hill-plantations, inaccessible to cattle, Mr. Forbes Brown has experienced a considerable saving of hands, owing to the less bulkiness, and consequent greater portableness of the birds' manure.

The Chinese agriculturists, in everything proverbially tenacious of their native customs, are less exclusive in the selection of manure, and in addition to the latter and birds' manure, employ also night-soil, urine, fish-manure, and the residue of the fluid in which fish is salted, and shells of shell-fish. The Chinese will willingly undertake the renovation of houses for the sake of the night-soil. A strange characteristic caprice has come to my knowledge as superintendent of six hospitals. Five of these the Chinese refuse to renovate, and the alleged reason is the supposition that European medicines principally consist of mercury, and the night-soil therefore would "purge the trees." But to a sixth hospital (a lunatic asylum), they have no objection, as it is their opinion that "calomel is not used in curing fools." Night-soil is principally used in the cultivation of vegetables; urine for Sirih-Vine; fish-manure for spices; residue from the salting process for cocoa-nuts; and shells of shell-fish for onions and water-melons; but all are also indiscriminately applied to spice plantations. The Malays, in different parts of the peninsula, use powdered calcinated bones in the cultivation of rice; not, however, as a manure, but as a supposed preservative against the attacks of insects, for which purpose a quantity of this powder is spread over the paddy-fields, during the season of irrigation.

Mr. Edward Solly stated, that he had roughly analyzed the specimens of Ty Burong, which accompanied Dr. Cantor's paper; and found 100 parts to contain about five parts of ammoniacal salts, ten parts of nitrates, nearly twenty parts of organic matter containing very little nitrogen, thirty parts of insoluble earthy matters, consisting chiefly of silica and alumina, with a trace of phosphates of lime, and thirty-five parts of water. The different specimens varied slightly in the proportion of these substances which they contained; in all, however, there was found a very large quantity of moisture, and but a small quantity of nitrogen. The animal matter contained in the Ty Burong, consisted almost wholly of the undigested remains of ants, and various insects; it was insoluble in water, contained but little nitrogen, and at the common temperature was very little liable to decay. Almost the whole of the nitrogen, which originally existed in the manure, was now present in the form of nitric acid, combined with lime and potash. Mr. Solly had no doubt, from its composition, that it was an excellent manure, as well as a valuable addition to many soils, but he doubted whether it would be worth while to carry it to a great distance, as from the large proportion of

water and useless earthy matter present in it, amounting to nearly two-thirds of its whole weight, it was evident, that the cost of carriage to any distance would be very high, as compared with its real value as manure.—*(From the Agricultural Gazette; August*, 1845.*)*

A Spanish dollar=*4s. 6d.*; a coyan, 800 gantons, a ganton, 1¼ gallon; a pecul, 133⅓ lbs.

THE VALUE OF GUANO AS A MANURE.

We feel somewhat blameable for not having sooner directed the attention of gardeners to the extreme importance of guano as a manure for everything with which they have to do. We have left to our correspondents a task which rather belonged to ourselves. The consequence, however, is not disadvantageous, for all that we now have to say has so entirely the sanction of experience, that nothing is left for theory to speculate upon.

And yet there are those who cannot find in guano the virtues that belong to it. One man uses it too strong, and says it kills his plants; another applies it at the wrong time of the year and gets no result; another buys his guano cheap, of some swindling dealer who digs it on Epping Common, and condemns the manure forthwith as utterly worthless; he should have condemned his own folly for dealing with rogues.

Not a doubt can now exist that guano, of good quality, properly applied, is of all known agents the most valuable for manuring purposes. It contains just what matters are required by plants for their food, in just the right state; and although Mr. Lawes's superphosphate of lime may beat it in turnip growing, yet the statement we have just made is strictly true; for superphosphate of lime is not, like guano, of universal application.

Another merit in guano is, that it is not bulky, nor disagreeable to use, nor attended by any of the nuisances, which in small gardens are so great, with stable dung. A bag of it, which can be brought home in the carrier's cart, is as useful as a cart-load of farm manure. It is true that it will not produce the same mechanical effect upon land; but so far as manuring qualities go, it is unrivalled, and the mechanical effects may be otherwise obtained, as, for example, with chopped straw.

It has this great advantage too, that as it varies much in quality, the buyer can never be at loss what to purchase, for the dearest is always the best, therefore the cheapest; so that the market price, if respectable men are dealt with, will form a sure index to the true value of this commodity.

People say, what shall I do with it! I have bought Peruvian guano, and don't know how to use it. Is it good for peas? or roses? or trees? or cabbages? or asparagus? or what? It would be well if all answers could be as

explicit. Guano is good for all things which require manuro, and if Mr. Teschemacher is right, for other things also, for he tells us* that it is good for Silver Firs, and consequently for Conifers generally, which farm-yard manure invariably kills.

The main thing is the manner of applying it. We havo reason to think that for gardeners the best plan is to steep it in cow's urine, to pour off the clear fluid as a liquid manuro, and to uso the residue, from time to time, in the kitchen garden. But it may also be mixed with any dry soil and applied broadcast.

The time for using it is obviously, in small quantity, when a plant begins to grow, in larger quantity, whon the new growth is active, and in much largor quantity, when vegetation is in full career. The Peruvians, says Mr. Teschemacher, use it for thoir maizo in the following manner:—"Each crop has usually three applications of guano; the first, in small quantity, at tho time of sowing the seed; the second, a larger application, when the plant is less than half grown; and tho third, just previous to the commencement of ripening the seed. After each application, tho land is irrigated—that is, watered. From this latter circumstance it will bo seen, that tho first application is of the nature of a steep in guano liquor, which, no doubt, accelerates the germination of the seed, while tho dilution of tho guano prevents tho ombryo from being injured by tho action of tho manuro, and also causes the commencement of its decomposition, rendering it immediately availablo to the growth of tho young plant. Tho volatilo ammoniacal salts of tho first application being exhausted, tho second becomes necessary for the increased roots forming; and this, no doubt enters largely into tho substance of the plant, promoting in every way its growth, luxuriance, and production of seed. Of tho benefit of the third application, I confess I am unable to judge; never having tried it, because I was unablo to see beforohand the use of it. Nevertheless, I think that the common practice of a people, who have used guano for centuries, should not be slightly rejected without experiment, and it certainly shall be tried."

All we have to do is to imitate their practice thoughtfully and cautiously.

Mr. Teschemacher gives the following very interesting results of his experience in tho United States; we copy thom without abridgment, because of their great practical value:—

Lawns.—"In several cases, where sods have been laid down for lawns or embankments round houses, the most surprising growth has beon obtained by strewing the surfaco with guano, previous to laying on the sod. The manure is then brought into contact with the roots, which—being strong and old, not tendor and young, like the sprout and root of a seed—tako immediate hold, and this effect is produced without injury."

* Essay on Guano, 1845.

Vines.—"Here my individual experience is small, having only planted two vines, last autumn, manured with guano, which are growing vigorously. But many others have tried it on them with the greatest possible success, both as to growth of stem and fruit. This plant is a gross feeder, and will bear a great quantity of this manure without injury. Vines grown in pots will make a surprising growth if watered with a solution of guano; but, for the reasons given under the head of Indian corn, I think that the guano itself, containing the phosphate of lime, will give greater and better produce. The well-known success of others with this plant renders any evidence from me unnecessary. The best method of application is the same as for trees, which follows:"—

Trees.—"The experiments with guano on trees which have come under my observation, including exotics, number about one hundred and fifty. The action has invariably been to produce large foliage, of a deep, healthy green, or with plants, usually covered with a white powder, called *glaucous*, to increase this appearance, and to shorten the joints or intervals from leaf to leaf. This last action, as respects fruit-trees, is of the utmost importance; every one being aware that long-drawn, long-jointed shoots are the least valuable or productive, and that the fruit-bearing spurs on trees, are but branches with shortened joints. Hence the production of short-jointed, stocky branches, is the production of so much fruitful wood; and if, by proper pruning, the sun and air are admitted so as to ripen the wood, a plentiful crop must be the result. The best mode of application to fruit-trees seems to be, first, to consider where are the young feeding roots,—that is, at what distance from the stem, and what depth in the ground,—then to place the guano as near them and as much around them as possible, without being in absolute contact. For instance, round an apple-tree of ten years' standing, dig a trench, one or one and a half foot deep, at about the same distance from the stem that the branches extend; let this trench be about one foot wide; then put at the bottom one and a half inch depth of guano, dig it well in, and incorporate it with the soil; then cover up carefully, and press the earth down. The effect of this application will unquestionably be felt for several years. I am rather inclined to attribute this shortening of the joints chiefly to the action of the soluble portions of the guano; as the pelargonium, the orange, and many other plants which exhibited this appearance, had only been watered with its solution. But in all applications to fruit-trees, I recommend the guano itself, as the insoluble portion contains the chief materials of the seed, to protect and cover which, fruit is formed. Where young trees are to be manured, a little guano, dug in at the surface around the tree, as well as in a trench, will be advantageous. The use of guano for trees probably combines another advantage of inestimable value; this is, the destruction of the insect tribe which are buried in the earth, and emerge from thence with the warmth of spring. The coverings of these insects, when they first come

out of the ground, are not hardened; and, in this tender state, the contact with a moderately strong solution destroys them. I have tried experiments on about eight or ten various caterpillars, and some other insects, and have invariably found a solution of guano kill them quickly, except when in an advanced state; then it took a longer time and a stronger solution. Salt and oil-soap are both apt to be injurious to vegetation; but, by strewing guano around the trees, and turning it in a little depth, the plant will be benefited, and the insects at the same time destroyed. My experiments on this subject, although perfectly convincing and satisfactory to myself, have, for want of time, not been conducted with that care and precision which should authorize me to lay them before the public with requisite confidence. My last experiment was with the destructive grub, *melolontha,* so well known to subsist on the roots of grass, of which a friend kindly sent me a box. Six of these white grubs were placed in a saucer half full of water, in which a tea spoonful of African guano had been put and well stirred. They immediately began to feel uneasy, and, in about two hours, the whole six were dead."

Peas.—"The kinds on which I experimented were Prince Albert, Shilling's Early Grotto, (a dwarf pea,) blue imperial, and marrowfat. The method I adopted with all, was to draw a deep trench with a hoe, to strew guano in the trench, mix it up with the soil, over this put about one inch and a half of earth, then sow the seed, and cover up. In this way, I calculated that the young sprouts of the seed, both root and embryo, could not be injured by coming into immediate contact with the guano, and that, when the roots were strong enough to bear it, they would find the guano in that state of decomposition best suited for them. The quantity used was about three pints of Ichaboe guano to a quart of seed, sown, however, much thicker than is customary here. It will be observed, that in this case, the natural moisture of the soil, at the depth at which the guano was placed, was sufficient to bring it to a proper state of solution, and rendered the necessity of immediate rain not of so much consequence. When rain did come, it was beautiful to see the luxuriance resulting, and I felt persuaded that none of the virtue of the guano had escaped at the surface. The produce of the first three kinds of pea was five full pecks to the quart of seed, besides a full quart of seed gathered for next year. From the marrowfats I obtained only four pecks and a half, and no seed. The growth of all was extremely luxuriant. The marrowfats were six and a half feet high, the stems from one to one and a quarter inch in circumference. On the blue imperials, almost every flower bore fruit. On a stem thirteen inches high there were twenty-two pods. This was not at all uncommon, and such was the specimen I exhibited this year at the room of the Massachusetts Horticultural Society. Many pods of the crop contained nine or ten peas; these would be valuable for seed. I also exhibited very luxuriant specimens of Shilling's

Early Grotto in the samo hall. The joints, or distance from leaf to leaf, was very much shortened—an effect of guano which has been remarked on in its application to fruit-trees. I have previously observed that rain was not so absolutely necessary as is supposed. It will be seen, that in this experiment with the pea, the guano was placed at such a depth, that the natural moisture of the earth decomposed it, and rendered it fit for the plant. It is seldom that drought penetrates so deep as this into the soil; therefore, if the application be mado judiciously, dependent on tho nature of the soil, and if its capacity for retaining moisture be considered, the want of rain is not so fatal an objection to the use of guano as might bo thought. Thus, for instanco, in the lightest soils, plough and bury guano a littlo deeper than in others more heavy; the guano itself retains moisture, and absorbs it naturally."

Strawberries.—"A bed of Hovey's Seedling was planted in November, 1844, just previous to the ground being closed by frost. As early in the spring as the state of the soil would permit, I drow a trench, with a hoe, between the rows of plants, about two inches deep, put in guano, stirred up, and covered it over, thinking that the roots would naturally find tho guano. From this bed I gathered a plentiful crop of fine fruit, which I believe would not havo occurred without the guano, as tho soil was in a miserable, meagre state."

Forcing.—"This manure, owing chiefly to its ammonia, is of so stimulating a naturo, that it will start vegetation at any period when the temperature of tho surrounding atmosphere will permit it to proceed, and will, therefore, become of great importauco in forcing-housos. On roses, tho beneficial effect is already well known. If tea roses are cut down when the bloom is over, repotted in fresh earth, and well watered, twice or thrico a week, with guano wator, they will immediately throw out luxuriant shoots, and be covered with their fragrant blossoms. I have two tea roses in pots, which are now, for the fourth time, in bloom since February. I exhibited this year, at the room of the Massachusetts Horticultural Society, Echinocactus ottonis, threo years old from the offset, with three flowers expanded, and eight buds, not one of which failed to produce large, well-formed flowers; also Echinocactus eyriesii, in blossom, being an offset, three years old. The appearance of these plants was of the most healthy kind. But, with all succulent plants, in order to induce blossom, the luxuriant shoots must be well ripened by exposure to sun and air. I placed an Epiphyllum in the annual exhibition of the Massachusetts Horticultural Society this year, which I grafted June 17th, 1844; grown chiefly in moss, with very little soil, and watered profusely with guano water. It had thirteen shoots, many of extraordinary size and vigor. The cactus tribo will boar a larger quantity and stronger solution of guano, without injury, than most plants; but then the enormous shoots must be well ripened, or they will not produce much

blossom. This, of course, is the case with all fruit-trees. A large, soft, spongy growth of unripened wood, such as I have seen exhibited, is of no value whatever."

This sort of practical evidence is worth a ship-load of speculation, and will suffice to show our gardening friends, that, among their preparations for the ensuing season of growth, the very first thing is a supply of guano, of which good Peruvian is, beyond all doubt, the best.

It is said that guano improves flavor. This is a point upon which we shall not venture to touch at present.—*(From the Gardeners' Chronicle; January,* 1846.*)*

EXPERIMENT ON ELECTRO-CULTURE AT THE GARDENS OF THE ROYAL BOTANIC SOCIETY.

By Edward Harmer Sheppard, Esq.

In the early part of the past spring, my attention was directed to the subject of promoting an increased growth of plants by means of some particular application of electricity or galvanism. Considering that this is quite a new subject, and at present but very little understood, and that until the last few months it has never received that attention which its importance deserves, it is our duty to be very careful in our experiments, and very guarded in our inferences from them. The following description and remarks, therefore, are brought forward rather with a view to excite attention and induce further research than to propound theories, or to make assertions, which instead of promoting the object in view, might only tend to mislead.

It has long been believed that electricity produces a stimulating effect on vegetation. We read that as far back as the middle of the last century, a Mr. Maimbray, of Edinburgh, announced that he had succeeded in proving, that single plants separately electrified, grew more rapidly and vigorously than those which were not so treated; and since that time this experiment has been frequently repeated, and with the same results. It has been proved that the growth of a common hyacinth in a glass is much accelerated by giving it daily a few sparks from the electrifying machine. Sir Humphrey Davy likewise instituted experiments upon the germination of seeds, and he noticed that voltaic electricity powerfully affects plants, and that they grow very rapidly near the negative pole of the voltaic battery, and not quite so rapidly near the positive pole. He also observed that drooping plants may be made to revive on the artificial application of electricity. A highly charged state of the atmosphere, too, causes a more healthy color, and a more rapid development of leaf and branch. Every leaf indeed is proved to be a natural conductor of electricity, collecting the electric fluid which surrounds it, and

appropriating it to some necessary, but as yet unknown, purpose in its economy.

In the first week of May, I buried in that part of the gardens of the Royal Botanic Society appropriated to Agricultural experiments, a plate of sheet-copper, two feet in length and nine inches in depth, and also at the distance of about nine feet, a plate of zinc of the same dimensions. These plates were both placed in an upright position, facing the magnetic north and south, and connected together by means of two copper wires, which extended between them, at the height of about three inches above the ground. Each end of the wires was soldered to the upper corners of the plates, thus forming a galvanic battery; the moist earth completing the circuit.

Within this parallelogram of ground, were sown, in rows parallel to the plates, lucerne, sainfoin, clover, red globe turnips, and yellow globe mangold wurzel. Another parallelogram of ground, of precisely equal size and quality, and at the distance from the former of only eighteen inches, and uninfluenced by galvanism, was formed out at the same time, and sown in a similar manner, with an equal quantity of seed. No manure whatever was used on either side. In the course of three or four weeks, when the seeds had germinated, the difference between the two plots of ground was very obvious; the seeds on the galvanized side failed to a considerable extent, and the mode of their failure was this, that soon after the appearance of the cotyledons above the ground, the young plants began to droop and die off in a peculiar way. In this manner the clover and the sainfoin, which had been placed the nearest to the metallic plates, were destroyed to the amount of two-thirds, and the lucerne of one-third; while the mangold wurzel and the turnips, which were farthest removed from the plates, lost only about one-sixth of their number. These different degrees of injury received by the young plants, would, probably, depend upon the separate and relatively tender or more hardy nature of each species. It was, however, at this time, evident that a greater amount of galvanic power was generated than is congenial to the germination of those particular seeds.

All those plants, however, which survived the first five or six weeks continued to live, but, with the exception of the turnips and mangold wurzel, they were not at any time so healthy and strong as those on the other plot. But the turnips and the mangold wurzel soon presented a different character from the rest, putting on a more vigorous appearance, as well as a more rapid growth; and by the month of August, they had acquired a much larger size than the others, which were growing in the natural soil. They still continued to increase rapidly in bulk, and by the 20th of October, one of the turnips had reached the enormous size of 40¼ inches in circumference, and still increasing. This is, I believe, much the largest dimension that this variety of turnip has ever been known to reach. I then began to feel little doubt, but that in the succeeding six or eight weeks, during which all such plants continue to

increase, it would attain a most unheard-of bulk. But on that day, and when it had begun to excite considerable attention and interest among the Fellows of the Society, a most unfortunate circumstance occurred, and my hopes were doomed to disappointment; for it was then pointed out to me, that some person had wantonly thrust a stick into the heart of this fine root.

This injury put a complete stop to its further growth, and in ten days afterwards I gave directions, that this and all the other plants should be dug up. They were then carefully measured and weighed. The largest turnip was found to measure 40¼ inches in circumference, and to weigh 16½ lbs. The aggregate weight of the turnips on the galvanized plot was 27 lbs. On the other plot of ground, and growing naturally, the aggregate weight of the turnips was 5½ lbs. I should mention, however, that one of the turnips on this side had become rotten, and had then been nearly eaten by insects. This was an accidental circumstance, and had it not occurred, about 2 lbs. more in weight would have been added to the last-mentioned amount of 5½ lbs. The aggregate weight of the mangold wurzel on the galvanized side, was 14¼ lbs. On the other side, and growing naturally, it was exactly 10 lbs. Thus there existed a large difference between the produce of the two plots of ground; but how far the above increase on the galvanised side was really due to this cause, or to any unknown accidental circumstance of seed or soil, it would seem premature to decide from the result of a single trial. It is a subject that I trust will be followed up by others, and carefully investigated.

In describing the above experiment, I omitted to state, that during its progress, I was curious to ascertain if any, and what amount of galvanic power was generated by the metallic plates, and for this purpose, I occasionally applied to the wire a very delicate magnetic compass, and I always found that the needle was immediately more or less deflected, evidently showing that an electrical action was constantly kept up. And I was the better enabled to make these observations by the mode of my arrangement of the plates, for as the wires were extended, accurately, magnetic north and south, by placing the needle immediately above them, the slightest deflection was readily noticed. There were also other motives which led me to adopt this particular arrangement, which it would be impossible to detail within the limits of this paper.

In conclusion, from the results of this experiment there is every reason to hope, that by perseverance, and a judicious alteration in the form of the application of the galvanic power, which experience from time to time may suggest, that we shall gradually succeed in rendering it a most valuable agent in agriculture, as it would be folly indeed to expect any great results at present, whilst so completely in its infancy. For we know that some 40 or 50 years ago, it was stated by those who first discovered the nature and properties of steam, that they possessed a power, which in time, they believed, would perform wonders and cause a general transformation in travelling both by sea and land; but that they were ignorant of its proper application. This

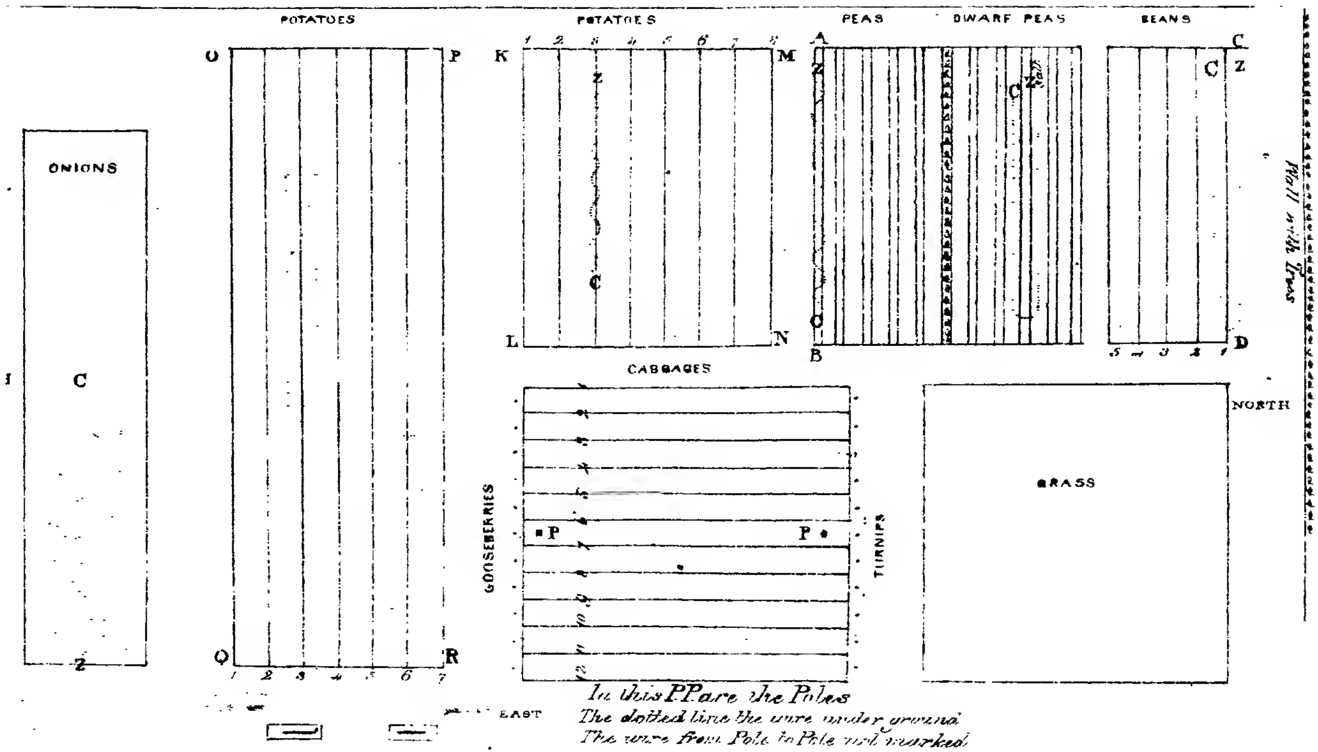
point was left for the next few succeeding years to accomplish. So it is at present with electro-culture. We are in possession of a power which has been proved to stimulate and increase vegetable growth at a very economical cost, and I do not entertain the least doubt, but that patient and persevering investigation of the laws of its nature, will discover the proper mode of applying it, and will utimately be crowned with success. [We tried similar experiments with sheets of copper and zinc, one foot wide and eight feet long; one pair were sixteen feet, and the other thirty-two feet apart. They were connected by copper wires. They were sunk in a wheat field, but no apparent effect ensued.]—*(From the Agricultural Gazette, 10th January,* 1846.*)*

INFLUENCE OF ELECTRICITY ON VEGETATION.

The question whether electricity has, really, any effect on the growth of plants, can only be decided by a series of careful and accurate experiments. Every person, therefore, who can offer a fact upon the subject, will aid in the curious and interesting inquiry, from which many have been repelled by the unphilosophical methods employed, and the hasty deductions incautiously and inaccurately announced. Having paid some attention to the statements made respecting certain experiments, I tried several myself during the past year. When the Potatoes I exhibited at the Royal Institution, in May last, in pots, one treated with a galvanic circuit of a plate of copper and zinc, were taken up, the produce of the galvanized tuber was ten ounces in weight, and of a similar one not galvanized, five ounces. They were weighed at Chiswick by Mr. Edward Solly.* Having expressed an opinion that the mode recommended by Mr. Forster would be found of no avail, I determined to try that, and another method. I surrounded a plot of Potatoes with the wires as he directed, and found no difference whatever in them from others adjacent, at the period of taking them up. At the same time, I erected two poles, about twenty feet high, in another part of the same garden, across which I stretched a copper wire one-sixteenth of an inch in thickness, carefully insulating the poles by covering them with a cap, lacquering their tops with a solution of sealing wax in naptha, and glass tubes passing through the poles, into which the wire was inserted. From this cross wire I suffered four or five other wires to hang perpendicularly with several branching wires at the extremity of each, descending within about two feet of the ground. A row of similar Potatoes was planted in the same soil, and left entirely to themselves. On taking them up at the end of the autumn, the produce of

* Two similar pots left in Norfolk gave, galvanized, 17 oz. ungalvanized, 16½ oz.—scarcely to be called a *result.*

those under the wires was about double that of the others, and while the latter contained only one pound and a half of really sound tubers, the disease having caught them to a great extent, the former gave sixteen pounds weight, perfectly sound and healthy. I am aware that this is merely a single fact, that no hasty inference can be deduced from it, and I only state it to persuade others to similar trials, which I intend to repeat myself. It is also fair to say, that I know of the experiment being tried on cereal plants in the like way, and there was no visible result, except a very slight one in one case. I may, perhaps, be permitted to mention the apparent effects of a few experiments with galvanic batteries. On June 3d, I sowed two pots of Mustard seed; in one, I placed the terminal wires of two cells of Smee's battery. It came up much sooner than the other pot of seed, and grew with far greater vigour. In June, also, I placed a Pumpkin-seed in a pot between a single circuit of zinc and copper. It was far inferior to a similar seed in growth and development sown in the ordinary way, and came to nothing. On June 3d, a similar application made a great apparent difference in a cutting of a Pelargonium, giving it, as it seemed, a vigorous growth in comparison with a similar cutting with no application. The same day I treated a Kidney Bean in like manner; the advantage over the other planted for the comparison was most striking; the former was in rough leaf, before those of the other unfolded. In my own garden, and in that of a neighbour, the single circuit of copper and zinc seemed greatly to affect, by comparison, a row of Peas. On July 4th, I placed the terminal wires of a large cell of a Daniell's battery, at the extremity of the young shoot of a Pelargonium. It withered and died in five days. The same experiment was tried upon a Balsam a few days before; it withered and fell in twenty-four hours; in forty-eight hours it looked as if it had been scorched by a fire. I made likewise several other experiments, and with the exception of one Melon plant, which flowered before any flower-buds were visible on two others in the same frame, there is no result. It would, therefore, be in vain, till further investigation has been made, to speculate on the causes which produced those appearances, which I have described. I simply state them for the information of persons curious on this interesting matter, and while I deprecate every hasty conclusion, I would venture to observe that a hasty abandonment of research, on a question so worthy of it, is at least equally to be regretted. If I had only tried a few experiments, I might have seen nothing to mention, and concluded with others that electricity had no effect; but while many, that I did try, gave no indication of any result, those I have described, for some reason or other, seemingly connected with the application of electricity, issued in the manner stated.—*Edwin Sidney, Acle, near Norwich.—(From the Agricultural Gazette, 7th February,* 1846.*)*



In this PP are the Poles
The dotted line the wire under ground
The wire from Pole to Pole not marked

EXPERIMENTS ON ELECTRO-CULTURE. BY ANDREW FYFE, M.D., F.R.S.E., F.R.S.S.A., PROFESSOR OF MEDICINE AND OF CHEMISTRY, UNIVERSITY AND KING'S COLLEGE, ABERDEEN. (WITH A PLATE.) COMMUNICATED BY THE ROYAL SCOTTISH SOCIETY OF ARTS.*

The interest which has been excited, by the publication of the result of Dr. Foster's trials on Electro-Culture, has induced me to put the proposed method of increasing the produce of the soil to the test of experiment, not only by the method followed by Dr. Foster himself, but also by galvanic electricity, as recommended by others, as a more effectual mode of applying the electric agency. Having fortunately had a piece of ground for a kitchen-garden under my command, I had it prepared by digging, and manuring with ashes and stable-manure in the usual way, and the crops were put into it at the proper time. (See Plate.)

The first trial was conducted as recommended by Dr. Foster. For this purpose, two poles were erected, north and south of each other, and the wire (copper) carried along them, and sunk in the ground, as described by him. The quadrangular wire enclosed seven rows of cabbage plants,—three to the west and four to the east of the poles. Of the twelve rows, as shewn in the plan, 1 and 2 were Victoria cabbages; 3 to 9, inclusive, early Yorks; 10, 11, 12, late Yorks. Accordingly, one row of early Yorks was without, and the remainder within the quadrangle; and one of the late Yorks was within, and two without, the wire.

The wire, passing on the north from east to west, also included part of a row of turnips, sown at the extremity of the cabbages; and that on the south, took in seven of a row, of twelve young gooseberry bushes.

The ground, at the time the wire was erected, was very dry; and there was also very little sunshine; thermometer varying from 56° to 44° Fahr. On 31st May, there was bright sunshine; thermometer 52°.

1*st June.*—Bright sunshine; weather has been dry. Can perceive no difference between the plants within and beyond the wire.

8*th to* 13*th.*—A good deal of sunshine; weather hot and sultry; thermometer varying from 64° to 76°. No difference between the plants.

23*d.*—No difference observable.

At this time, orders were given to cut the plants for use, as required, and to take those that were ready; the person who received the orders not being aware of the nature of the trials that were in progress, nor of the situation of the wire in the ground.

27*th.*—Cabbages cut from 6, 7, 8 (*within*).

30*th.*—One cut from 3 (*without*).

* Read before the Society, December 8th, 1845.

8th. July.—Many within the quadrangle not so far forward as those of 3,—cut two plants from 3 (*without*).

At this time, the gardener who prepared the ground and put in the plants, and who was not aware how the wire was situated, was requested to inspect the plants, and to report as to their condition. His report bears, that many in 3 (*without*) were farther forward, and better cabbages, than many of those in the rows from 4 to 9 (*within*),—all of these being early Yorks, and planted at the same time: that of the rows 10, 11, 12, the plants in 12 (*without*) decidedly the best; these being late Yorks; and that two of 12, the only ones ready, ought to be cut.

14th July.—One in 10 (*within*) cut.

15th.—Two in 11 (*without*) cut.

After this, the plants were cut by the individual alluded to, on some days from *within*, and on some from *without*, the wire; the latter being ready, while others *within* were not ready for use.

From the results above stated, I think we are warranted in drawing the conclusion, that the wire embracing the plants had no influence whatever in promoting vegetation, either by accelerating their growth, or increasing the amount of produce.

With regard to the row of turnips near the north line of wire, owing to some cause of which I was not aware, they never came to maturity, either within or beyond the wire. When examined, from time to time, they all seemed to be in the same state of advance; sometimes the one, sometimes the other, appearing to be the better; but certainly there was no decided advantage on either side.

As to the gooseberry bushes, the fruit was at maturity at the same time, and the crop as abundant on the one, as on the other.

Having thus failed in obtaining the expected results, I was naturally anxious to ascertain whether the wire as erected, had the power of receiving the electricity, as stated by Dr. Foster, and of conveying it to the earth; and this was tried in a variety of ways,—indeed, in every manner I could think of, and the following were the results.

The first trial was made with a galvanometer, consisting merely of a needle suspended within a coil of armed wire, the ends of which were connected with the wire passing down the pole to the south, and which wire was cut, to enable me to make the connexions. Near the galvanometer, another needle was placed, but beyond the influence of each other;—they both pointed exactly in the same direction. This experiment was repeated again and again, varying the connexions of the wires, and always with the same result.

Not satisfied with this, I next had recourse to a more delicate galvanometer, consisting of astatic needles, with a coil of wire 300 inches in length. One end of the cut wire passing down the pole was connected with one end

of the galvanometer wire; the other end of the pole wire had a metallic cup, containing mercury, attached to it, and into which the other end of the galvanometer was dipt, all the surfaces being well mercurialized. On breaking and on establishing the chain of communication, by raising and dipping the galvanometer wire into the mercury, not the slightest movement of the needle was observed.

At the time that these trials were made, owing to a fall of rain on the previous day, the poles and plants were wet; the experiment was therefore again and again repeated, varying the connexions, after the weather had become dry, with bright sunshine, and still with the same results. I next tried whether a gold leaf electrometer would be affected by contact with the wire. For this purpose it was placed on the end of the cut wire, after being thoroughly dried, so as to be easily moved by approach of sealing-wax slightly rubbed, and the other end of the wire was then brought in contact with the brass plate at top. Not the slightest divergence of the leaves was observed. The connexion of the wire was then changed, and the result was the same. This experiment was repeated several times on different days, during different states of the atmosphere, and in various ways, and always with the same result.

In a letter published by Dr. Foster, in the Farmer's Miscellany, in reply to one containing some remarks on his electro-culture experiments, he states, that the approach of a magnetic needle to the wire, as erected by him, shewed that there was an electric current along it, the poles of the needle being attracted and repelled according as they were brought near the different parts of the wire. I have repeated these experiments, as stated by Dr. Foster, but I never found that a magnetic needle was in the slightest degree affected by approach to the wire—neither being attracted nor repelled by any part of it; nor did I find that when the needle was placed near the wire, and the chain of communication was broken, which I could do by the mercurial cup which was placed for the other experiments, that there was the slightest movement either in one direction or the other.

I may here state, that, in conducting these trials, to ascertain whether there was any electric current along the wire, I had the advice and assistance of scientific gentlemen, who took an interest in them, so that the results recorded are from their observations as well as from my own, which gives an additional security for the faithfulness of the statements.

While engaged in conducting the experiments now recorded, I was at the same time occupied in carrying on others, with the view of ascertaining, whether, by other means, as by galvanic electricity, vegetation could be promoted.

I am aware that several statements have been given of the results of trials made with this electric agent, but unfortunately these statements are very contradictory; and it is much to be regretted, that, while some have allowed

that it has a beneficial influence, and others that it has not, the results have not been given, with that degree of minuteness, that would enable us to judge as to the effect,—as in all that I have seen recorded, there is simply an assertion, either that there was no difference, or that galvanized plants seemed better than the others. I trust that the following statements of the trials I have made, under a variety of circumstances, and with minute attention to every thing connected with them, will not be devoid of interest.

On the plan as given, the space ABCD contains six double rows of peas, five double rows of dwarf-peas, and five rows of beans.

17th May.—The first set of peas and the beans were about five inches high. At one extremity of the row of peas *a b*, there was then sunk in the ground a plate of zinc, and at the other end a plate of copper, each six inches by four, and connected with each other by a copper wire, which passed under ground, between the rows of peas.

10th June.—The peas in the galvanized row looking decidedly worse than those in the other rows; but this row was more exposed than the others to wind, which for some days previous, was very strong.

13th.—The peas in all the rows just come into flower.

23d.—Some of the peas in all the rows in pod.

5th July.—Could observe no difference on the different rows. The pods seemed to be advancing in the same state in all.

28th.—Peas for the first time pulled for use, and got from all the rows.

1st August.—Since last date, have taken pods from the different rows at different times; those from the galvanized row not more advanced or more numerous than those on the others.

Beans.

17th May.—A zinc plate was sunk in the ground at one extremity of the row of beans, marked *a b*, and a copper plate at the other side of the same extremity, and at the distance of four inches. A wire was passed, from the one to the other, under ground, and enclosing the row of beans along its whole length, as shown by the dotted line.

10th June.—Bean stalks of the galvanized row a little taller and stouter-looking than the others.

15th.—Beans in all the rows coming into flower.

23d.—Beans in all the rows in full flower; those in the galvanized row shewing more of the curly leaf at top, than in any of the others.

1st July.—Took off the tops from all the beans.

5th.—No difference observable in any of the rows.

12th.—Beans of all the rows in pod.

1st August.—Bean pods continue to enlarge in the same way in all the rows. No difference observable.

26th August.—Since last date, pods have continued to enlarge in same way; the stalks and pods were counted in all the rows—the pods being, as to size, nearly similar in all the rows, and the following was the result:—

	G. 1.	2.	3.	4.	5.
Stalks, ...	36	36	34	36	36
Pods, ...	69	78	164	173	222

No. 1 was the galvanized row. The difference in the produce of these rows is certainly very remarkable, more particularly between the two first and that immediately adjoining, and also between the two first and the other three. With respect to the two former, they were nearer than the latter to the garden wall, and were also just under the extremities of branches of trees at the side of the wall. Whether this would account for the difference, I leave those qualified to judge, to say; but, be this as it may, there was no preponderance in favor of the galvanized row over that immediately adjoining it, far less in favor of it as compared with the others.

Dwarf Peas.

16th June.—A zinc and copper plate were sunk in the ground, with a wire connecting them, and embracing the row of peas, as in the trial with the beans, but with this difference, that the wire, instead of being sunk in the ground, was kept at the distance of a few inches above it, and in contact with the stalks. A little sea-salt was also placed in the ground on each side of the zinc plate. The ground was very wet when the experiment was begun.

23d.—Peas near the zinc plate drooping. To try whether this was owing to the electric current or to the salt alone, some salt was put in the earth near the peas of another row.

12th July.—Two of the rows, *not galvanized*, in flower.

15th.—A third row, *not galvanized*, in flower. Peas near the salt last put in, drooping.

16th.—*Galvanized* row in flower. After this, the peas in all the rows advanced regularly, and, when inspected from time to time, no difference could be observed between the different rows.

Onions.

16th June.—A bed of onions, which where sown some time before, was weeded on the 12th June. They were about three inches above ground, and very irregular. On the 16th, a zinc plate, with sea-salt, was placed in the ground, at one end of the bed, and a copper plate at the middle of the bed, at the distance of ten feet. They were connected by a wire twenty feet in length, spread over the surface of the ground in a tortuous manner, and lying in contact with the leaves of the onions. The other half of the bed was left without galvanic plates.

23d June.—Can observe no difference between the galvanized and non-galvanized parts of bed.

5th July.—No difference observable between the different parts of the bed.

20th.—Onions not a good crop ; equally deficient in all parts.

At this time was recommended to water them with solution of nitrate of soda, with the view of destroying a small worm with which they were infested. The solution was applied equally over the whole bed.

1st August.—Onions continue to enlarge, though slowly ; do not seem improved by the nitrate.

10th.—No difference between the different parts of bed.

After this they continued to grow without any observable difference ; and when taken up in October, there seemed no difference between those in the different parts, either as to size or produce—a few of them were good in both parts of the bed, but, in general, they were small.

Potatoes.

16th June.—The potatoes at K L of plan were *hoed up* on the 12th ; and, on the 16th, a copper and zinc plate were sunk in the ground, at the distance of six feet, and connected with each other by a wire kept about two and a half feet above ground, and out of contact with the stalks.

23d.—Observed no difference between the galvanized and non-galvanized rows.

5th July.—No observable difference ; tubers of the size of a pea, at different stems in different rows.

20th.—No difference.

1st August.—Tubers enlarging, apparently, in the same way in all the rows.

15th.—Potatoes ready for use ; at this time raised two stems from different rows indiscriminately, and weighed them ; and did the same on the 17th. The following is the result :—

		2.	G. 3.	6.	7.	8.
August 15th.	...	...	$15\frac{1}{2}$	...	..	$17\frac{1}{2}$
" 17th.	...	$13\frac{1}{2}$	22	18	18	...

No. 3 is the galvanized row.

Thus four stems of the galvanized row, yielded $37\frac{1}{2}$ oz. ; and eight from the non-galvanized gave 67, that is, $33\frac{1}{2}$ for the four stems. Here there is a slight difference in favor of the galvanized row.

This crop was very deficient as to produce.

23d June.—The plot O P Q R on plan was sown with early kidneys at the usual time ; those marked from 1 to 5 inclusive being sown a little later than those marked 6, 7. Of these rows, Nos. 3 and 6 were subjected to the action of a galvanic current. For this purpose, a diaphragm battery, consisting of a copper trough, presenting seventy inches of surface, with a zinc

plate, 6 inches by 4, was used; the bag containing the zinc being filled with salt and water. The connecting wire of the plates attached to No. 6 was passed along one side of the row of potatoes to the distance of ten feet, then made to cross them, and then brought up on the other side. With this wire, which, in this case, was above ground, and in contact with the stalks, there was connected a galvanometer, to ascertain when the current of electricity ceased. When this was observed, the salt solution was renewed, and in this way the action was continued, renewing the solution from time to time as required, till the middle of August.

A similar adjustment was followed with No. 3, with this difference, that the wire extended to the distance of twenty feet along the row, and was sunk in the ground near the roots; the action was kept up as in the other for the same time.

5th July.—Tubers observed at all the rows.

26th.—Began to use the potatoes, and continued to do so, occasionally raising two stems from the rows, and weighing them. The following is the result in ounces, Nos. 3 and 6 being the galvanized rows: —

	1.	2.	G. 3.	4.	5.	G. 6.	7.
July 26th.	14½	12½	9	10	12½	19½	17½
August 2d.	6½	8	8½	9½	6½	7½	12½
„ 21st.	...	...	...	...	...	19½	21½
	21	20½	17½	19½	19	46½	51½

Thus six stems of the galvanized of those first planted (No. 6), yielded 46½, while the same number of the non-galvanized gave 51½.

Of those later planted, four of the galvanized row (No. 3) yielded 17½, while 16 of the non-galvanized gave 80, that is, 20 for the four stems.

In this trial, the difference is against the galvanized rows. Taking the produce of the galvanized rows of both, it is 64; of the non-galvanized, it is 71½. Taking the conjoined results of all the trials—that is, seven stems galvanized, and seven non-galvanized—they are as 101½ for the former, and 105 for the latter; a difference so trifling, as to be altogether unworthy of notice.

Cresses.

20th June.—Some earth from an adjacent piece of ground was thoroughly mixed, and the flower-pots were filled with it, and cress seed sown in both. In one of the pots was placed a zinc and copper plate, one at one side, the other at the other, and connected by a wire above the earth; the other pot was without plates.

Some of the same earth was put into a wooden box, a foot in length and six inches wide, and cress seeds were also sown. At one end was placed a zinc plate, and, at the distance of six inches, a copper plate, in the middle of the box. The plates were connected by a wire above the earth, and thus one-half of the seeds were embraced within the circuit.

At same time, cress seeds were sown in a part of the garden ground, in two distinct plots, near each other, occupying each a foot in length, and half a foot in breadth. One of the plots had a zinc and copper plate sunk in the earth, at the distance of an inch from each other, contact being prevented by the interposition of a small rod of wood. From plate to plate, there was passed a wire, under ground, forming a quadrangle, rather less than the area occupied by the seed—of course lying in contact with the seed.

24th June.—Leaves of cresses just appearing in the box, all over the surface ; and also in both of the ground plots, at eight A. M. ; at two P. M., leaves appearing in both pots.

25th.—Leaves continuing to enlarge ; no observable difference between the different parts.

26th.—No difference.

After this the plants continued to advance, in the same way, in all the different parts, till the

5th July.—The galvanized pot not so healthy-looking as the other ; but really very little difference.

10th.—All the parts apparently the same.

15th.—The same.

28th.—Weather dry. Cresses in box and in pots beginning to fade.

31st.—Almost gone. Watered the box all over.

1st August.—The plants in the box revived, and the same all over.

2d.—Watered the pots.

4th.—Plants revived.

9th.—All healthy again ; cresses in ground-plots continue healthy.

28th.—Up to this time inspected the plants in all the different places, again and again, but never could observe the slightest difference between them—that is, comparing plot with plot, pot with pot, and one part of the box with the other. At this time they were all in flower, each two having come into flower at the same time.

After this I never could observe any difference.

I have thus recorded faithfully the results of the trials I have made, on the proposed application of electricity to vegetation. From what has been stated, we must, I think, conclude, that, in these trials, no benefit whatever has accrued from the different processes followed. It must not, however, from this be supposed that I have come to the conclusion that electricity is of no avail in promoting vegetation ; and that, therefore, electro-culture must be abandoned, as a delusion. I must confess, that, from the mode in which it has been proposed to apply the electric agent by Dr. Foster, I have my doubts as to the plan being of any service ; at same time, I cannot but condemn the very hasty conclusions at which some have arrived, and the very severe animadversions that they have thrown out, without having given the plan the scrutiny to which it was entitled ; for, surely, if the results of an experiment have been recorded, and in which a decided benefit is stated to

have taken place, it is not in the true spirit of philosophic induction to meet that statement, and to try to prove its fallacy by assertions not supported by experiment, but founded merely on preconceived opinions ; far less does it become any one to bring into ridicule, by assertions thus thrown out, the efforts of one who, from all that we can judge, has given a faithful record of what he has done, and done with the view of benefiting others. Those who act in this way, forget that the ridicule they attempt to heap on others may recoil on themselves,—and recoil with redoubled force, should the results they have attempted to deny, be ultimately found correct. I trust that the results, I have now stated, will not deter others interested in discovering the truth, from prosecuting the subject. It is one well worthy of prosecution ; and it is to be hoped, ere abandoned as useless, will be put to the severest scrutiny. Notwithstanding the little encouragement I have received, I shall not be deterred, should time and opportunity permit, from renewing my trials, at the proper season, and, if possible, on a more extended scale.—*(From the Edinburgh New Philosophical Journal, Oct.* 1845, *Jan.* 1846.*)*

TRANSMISSION OF BULBS FROM INDIA.

Bulbs, experimentally prepared for a voyage to England, were received from India by the Court of Directors of the East India Company, and sent to the Garden for examination. One half of the bulbs were simply wrapped in cotton and packed in brown paper, while the other portion (of the same kinds of bulbs) was encrusted in a kind of white wax, and covered with cotton like the others. When received at the Garden in June, 1844, those bulbs which were simply packed in cotton and brown paper had omitted roots on the journey, and the tops in most cases had grown considerably, while those coated with wax remained quite firm and as fresh as when first packed ; although, according to the statement on the outside of the parcel containing them, they must have been confined in the wax three months. The bulbs transmitted in cotton began to grow first, but soon showed symptoms of debility ; while those sent in wax did not move much before a month after they were potted, but then they grew strong and healthy. In one or two cases, the bulbs perished in the cotton, while the same kind, packed or coated in wax, survived the journey.—*(Journal of the Horticultural Society of London,* Part I, Vol. I.)

MODE OF TRANSMITTING CUTTINGS FROM ENGLAND TO INDIA.

In our Paper for the 10th of January, is an extract from the "Journal of the Horticultural Society," detailing the results of the growth of bulbs transmitted from India, and sent from the India House to the gardens of

the Society, and of which one half was packed in cotton, and the other enveloped with wax. It is shown that the latter, though they had been confined in the wax for three months, appeared quite firm and fresh, and though they did not move for a month, yet afterwards grew strong and healthy; while those sent in cotton and brown paper had grown considerably in their transit, and when potted, grew first, but soon displayed symptoms of debility.

The above experiment originated in the successful results which attended the transmission of some seeds similarly enveloped in wax from the India House to different parts of India. Though the mails give great facilities for the transmission of such things as far as the shores of that country, yet it is not an easy matter to send them across the length and breadth of India in the different seasons of the year, the country being at one time inundated with rain, at another scorched up with heat, and having only a few months of comparatively moderate weather. In the moist weather, roots, seeds, &c., are apt to be rotted, and in the hot weather, parched up. Caoutchouc cloth forms a good protection against external moisture, but equally prevents the escape of any that is enclosed, and that is apt to be the case with things packed up in the rainy season. Cotton in this case is useful in absorbing moisture, but is objectionable for this very reason in the dry weather, though having the advantage of being a bad conductor of heat.

The idea of enveloping some seeds and bulbs in wax, originated in the difficulty of sending such seeds as the Spanish chesnut and the filbert, which it was desirable to introduce into the Himalayas. Of the chesnuts, all those at first sent were either dried up, or completely decayed. It appeared that if they could be hermetically sealed up, there seemed no good reason why they should not arrive in good order, even in the most distant parts of India. A thick coating of gum was first thought of, but it did not answer at first, from being too diluted. We know not why, if seeds are stuck into a thick mucilage and allowed to dry, it should not answer. Wax, just a little melted, was then tried, and with complete success in repeated attempts. The chesnuts and filberts were described as arriving at Bombay, Calcutta, and Saharunpore, in a perfectly sweet and fresh state. Both vegetated, and those sent to the Saharunpore Botanic Garden are now growing in the Himalayan Mountains. The wax has also been employed for enveloping the ends of cuttings of fruit-trees, which have also arrived in a living state; so much so, that apples, pears, and plums sent in this way, are now about three feet high in the same locality; and no doubt they will bear fruit there, as a Ribstone pippin introduced about the year 1828 from Liverpool, bears very fine fruit, and was this year covered with thousands of apples. The above facts may be useful to some of our readers, in conveying to a distance seeds and bulbs which are difficult of transmission.—F. R. (*Gardener's Chronicle, 24th January*, 1846.)

Correspondence and Selections.

CORRESPONDENCE ACCOMPANYING CERTAIN SPECIMENS OF WOOD FROM DARJEELING AND CHOTA NAGPORE. WITH A REPORT ON THE SAME, BY CAPT. H. GOODWYN, ENGINEERS.

To JAMES HUME, ESQ., *Honorary Secretary, Agricultural Society.*

DEAR SIR,—I have the pleasure to forward an original letter, addressed to me by Dr. A. Campbell, the Superintendent of Darjeeling, together with the specimens of wood to which he alludes. These, I think, will be acceptable and interesting to the Society, who probably have the means of giving Dr. Campbell the information he requires.

Calcutta: Your's, &c.
July 1st, 1845. (Signed) C. BEADON.

To CECIL BEADON, ESQ.

MY DEAR SIR,—I have forwarded by dâk bhangy to your address, six specimens of wood from Kursiong, in the Darjeeling territory, and shall be glad to have the result of any report you may obtain on their value, after trial of their strength and other qualities. There are an immense number of excellent woods in this territory, which it would be highly desirable to introduce to the Calcutta market. If you could ascertain the probable market value per 100 cubic feet of the kinds now forwarded, I would endeavor to ascertain if they could be profitably forwarded to Calcutta in large quantities.

The specimens sent have been taken from Kursiong, as that place is within five miles of *hackery* carriage. There are many more kinds of wood in the same place.

I have kept duplicates of the specimens sent to you, with corresponding Nos. on them, so that it will be sufficient to indicate each by mentioning the No. of it.

Darjeeling: Your's, &c.
June 9th, 1845. (Signed) A. CAMPBELL.

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To James Hume, Esq., *Honorary Secretary, Agricultural Society.*

My dear Sir,—I beg to send you samples of two very beautiful kinds of wood, which I have come accidentally across in the junguls south of this station.

The specimen marked No. 1, is known to the jungul people (Sontals, Bhoomijes, &c.,) who call it 'Kendar,' or 'Keeria;' but I do not hear that they make any use of it. The appearance of the sample will speak for itself. To *my* taste—it is more beautiful than mahogany, having a *rosy* hue, which that wood has not. The sample is cut from near the bark, so as to give a fair average idea of the wood. The heart is of course superior and still richer in color. It works easily and smoothly, does not chip or crack by the weather, and the grain, as you will perceive, is so fine, that the smallest work with the highest finish could be done in it.

The specimen No. 2, is coarser and inferior, but still I think handsomer than 'Toon.' The tree is unknown and unnamed here. The one from which the sample was taken was cut down by a carpenter of mine, out of mere curiosity. This wood also appears to stand the weather well. I showed a log of it to Colonel Ouseley, G. G. Agent S. W. F., who appeared to think it was the 'Rohunee,' or Mahogany of Upper India, but was uncertain.

Of the trees, I cannot yet speak so as to describe them properly, but in the cold weather I shall endeavor to visit the jungul where they are found. (The trunks are large enough to give planks of two feet breadth.) In the meantime, I have sent people to bring in all the young plants they can find—also the seeds (if on the tree). And I propose sending some of both down to you, if you consider them acceptable.

I cannot but think that the production, in places so near Calcutta, of so beautiful a wood, for the purpose of ornamental furniture, &c., is an object of some importance, and I would beg to suggest to the Society, the advantages likely to be gained in forming large plantations of a tree which may perhaps, by better judges than myself, be thought mahogany.

The trees hitherto found, are described to me as growing on the banks of water-courses at the foot of hills. The moist soil of Bengal

might possibly be unfit for their growth; but the wood would be, I think, sufficiently valuable to cover the expense of land carriage from hence to Calcutta, or at all events from Bancoorah to Calcutta, supposing that the plantations could not be established at the latter place.

In conclusion, I shall be most happy to receive any instructions from judges in these matters, as to the points of information necessary to be furnished, previous to the Society coming to any resolution respecting the plantations, the establishment of which I earnestly hope will not be neglected.

Poorulia: I am, &c.
June 19*th*, 1845. (Signed) S. R. Tickell.

My dear Sir,—I am quite ashamed to keep the specimens of wood you sent me any longer, and my many duties and the various calls on my time must plead for the delay as well as the imperfect nature of this communication.

The names of the wood I cannot correctly ascertain, though I have made many enquiries, but from the properties of Nos. 2 and 4, I am led to suppose they are of the species 'Goomar,' though No. 6 has so much more elasticity than the other specimens that it approaches to that of Soondree, between the specific gravity of which, and that of No. 6, is scarcely a difference: the mean of the specific gravity of the six specimens is ·514,—and assuming

The Strength of Saul,...... @ 100
„ Stiffness of ditto,...... „ 100
„ Toughness of ditto,.... „ 100

The relative values of No. 6 (the most favorable specimen) will be

Strength,.............. 80·
Stiffness,.............. 94·
Toughness,............ 82·

The greatest weight, whilst the elasticity of No. 6 remained perfect, was 625lbs., and twenty-nine inches the greatest deflection. The breaking weight of No. 6 was 2,576lbs., the section two inches, and distance between the supports ten and a half inches; from these results I do not consider the woods fit for building purposes, but may be employed for light planking, panelling, venetian blinds, picture frames, &c., where shrinkage is to be avoided. In the sections will be ap-

parent the amount of the area that has been subjected to compressive action, and that to tensile force by the weight applied, and which is nearly the same in all.

The wood called 'Kheria,' I consider to be useful for all purposes to which Toon is applied, though I doubt the probability (as stated by your correspondent) of its taking so good a polish.*

Fort William: Believe me, &c.
27th April, 1846. H. GOODWYN.

BENEFICIAL EFFECTS OF UNDER-DRAINING. COMMUNICATED IN THE FOLLOWING EXTRACT OF A LETTER FROM MAJOR JENKINS, DATED GOWHATTI, 25TH APRIL, 1846.

"I intended to have written to you some time ago with reference to my communication in the 3rd vol. p. 89 of your Journal, noticing the recovery of a piece of bog-land by under-draining. For two years I have had a small portion of the worst of the land cropped with sugar-cane, the produce from which was very fair indeed this year.

"A piece of land, which by a subsequent survey, was one rood and thirty-two perches in extent, was under cane this season, a part, nearly half perhaps, being of the first year's planting, the other part of last year's. The canes of this portion were very fine, and I had cut some of the best, intending to give away the whole to my servants, when Mr. Herriot offered to make sugar for me of what remained.

"Mr. Herriot kept my juice separately, and sent me the out-turn in excellent sugar, weighing six maunds and twenty-six seers, which I believe is a very fair return for less than a half acre of cane any where, and as the produce of land that was, before I began draining it, too wet for rice, it will, I think, be considered very satisfactory.

"On other parts of the land I had crops of garden vegetables, but the greater part was under wheat and barley, which grains grew ex-

* "I hope next month to send you a teapoy made of a single plank of the Kendar wood, which I can never agree with Capt. Goodwyn, will not bear such a polish as Toon. However, you and the Society will by and by judge for yourselves."—*(Extract of a note from Capt. Tickell, dated 19th July, 1846.)*

tremely well, but the unusually early storms in March happened as both were just flowering, and did a great deal of mischief; last year, with a more favorable season, my wheat from the same land, was as good as any Patna wheat."

THE DATE TREE ;—ITS APPLICATION TO ECONOMICAL PURPOSES.

To the Secretary of the Agricultural Society.

DEAR SIR,—I have the pleasure to enclose a memorandum respecting the date tree, the mode of extracting its juice, the average quantity of sugar which it yields, and a few other particulars connected with its cultivation. I am fully aware, that the details here given must be known to many of the Members of the Society; but as I observe, that in the account of the tree in Roxburgh's 'Flora Indica,' some doubt is expressed as to the average produce of juice yielded by it, and that subsequent writers on the subject have not attempted to add any thing to what is advanced by that authority, it has struck me that this statement, founded on practical experience, may not be altogether devoid of interest to several, and that it may be useful for reference to a few of your Members. If you are of a similar opinion, perhaps you will have the goodness to submit it at the next General Meeting of the Society.

Jessore : I am, &c.
6th July, 1846. A CORRESPONDENT.

In the district of Jessore, to which the following observations are more particularly applicable,—though they will apply generally to other parts of Bengal,—the date trees are rented for a season comprising four months, (from November to February) at the rate of sixteen to twenty trees per rupee. In the month of Kartick, or beginning of November, the ryots commence taking off the withered leaves and bark from that part of the tree from which the juice is to be extracted, namely, a foot from the top. The tree is allowed to remain in that state till the barked part is dry, which takes from fifteen to twenty days. That part is then peeled again, and an incision made

in the shape of V: slightly hollowed, with a slant to the centre; and at the point or end, a reed of about eight inches in length is fixed to allow the juice to run through into a small jar which is tied immediately beneath. The juice is extracted from the tree from sun-set to sun-rise for three successive nights, (the part which has been barked being peeled afresh each night) when the reed is removed, and the tree is allowed the same period to regain strength. The juice is boiled as soon as possible, for should it even partially ferment, there would be no grain in the goor; the juice extracted during the day is not fit for goor. The produce from a healthy tree for the season is about nine maunds of juice, which yields about thirty seers of goor, and from an indifferent tree not more than ten seers of goor; so that fifteen seers of goor per tree, may be considered a fair average.

The following details will give an idea of the cost, assuming that one *gachee* (the person who extracts the juice) can manage 250 trees :—

Rent of 250 trees @ 16 per rupee, ...	15	8	0
Gachee, ...	16	0	0
2 Coolies for carrying and boiling the juice,	28	0	0
Firewood, in addition to dried date leaves, ..	5	0	0
Jars, ...	7	0	0
Pans for boiling, ...	5	0	0
Knives, ropes, &c., ...	3	0	0
	79	8	0
Produce of 250 trees, @ 15 seers of goor per tree = maunds 93-30, @ 1-8 per maund, ..	140	10	0
Profit, ...	61	2	0

One maund of date goor will yield twenty-five seers of khaur, or twelve and a half seers of sugar, which is sold in the bazaar at eight rupees per maund.

It may be added, that a date tree when left entirely to nature will not be fit for tapping till it has attained the age of from five to seven years; but when it is carefully cultivated, it will yield juice at the age of three to four years, when it can be turned to account. This careful cultivation consists in sowing the seed in the month of

April in a well manured bed, each seed about a foot apart; where it is allowed to remain for about twelve to fifteen months, when it is planted out in a field from eight to ten feet apart. During their growth the trees are well attended to, the leaves being trimmed to allow a free circulation of air, and the earth round the roots kept free from weeds. During this period the ground is well employed, being cultivated between the trees with mustard, teel, and such other crops for which the land is fitted.

FURTHER PARTICULARS REGARDING THE MANUFACTURE OF INDIGO FROM NERIUM TINCTORIUM. COMMUNICATED BY C. B. TAYLOR, ESQ.

To JAMES HUME, ESQ., *Honorary Secretary, Agricultural Society.*

MY DEAR SIR,—I have perused with much pleasure the clear and satisfactory letter of Mr. Fischer of Salem, dated 12th January last, (see page 9, Correspondence Department, of the last published number of the Journal,) supplying the data to enable us to estimate the probable produce of a biggah of ground planted with Nerium trees, and which greatly exceeds my most sanguine expectations.

Mr. Fischer says, a full grown tree will produce from 40 to 100 ℔s of leaf, and may be cut twice a year, also that it takes from 150 to 200 ℔s of leaf to produce a pound of indigo; one Bengal biggah, ten feet from plant to plant, will contain 144 trees, which at 40 ℔s per tree, the smallest quantity it is said to yield, will be 5,760 ℔s for one cutting, and for two cuttings 11,520 ℔s; this, at 1 ℔ of indigo for every 200 ℔s of leaf, will produce 57 ℔s of indigo. Now this is a little more than seven times as much as the common indigo plant will yield; it being considered a favorable season when ten biggahs of plant yield one maund of indigo, or ten maunds of indigo for every one hundred biggahs of plant; whereas the Nerium will yield, according to the data supplied by Mr. Fischer, seventy-six factory maunds for one hundred biggahs: this, most likely, could not be realized, as many trees would, in all probability fail, but one-third or even one quarter would prove a handsome remuneration, as it must be much less expensive to manufacture than the common indigo plant.

The boiler need not be so expensive as that described by Mr. Fischer, as the sides could be made of stucco work, the same as those now in use throughout Bengal and Behar.

I suspect, that the tree mentioned by Mr. Rehling of Chandmaree, Rungpore, (see page 30 in the same number of the Journal) is the *Asclepias tinctoria* of Dr. Roxburgh, and the *Marsdenia tinctoria* of R. Brown. Dr. Roxburgh says, ('Flora Indica' vol. 2, page 44,) "since writing the above I have learned, that this plant is a native of Cooch-bahar, and I had some of the plants sent me from thence, also from Pegue, from whence I have likewise received plants." The former named place is in Rungpore. I should be much obliged if you could obtain some seeds from this plant, likewise of the three plants mentioned by Mr. E. O'Riley, one of which it appears by a paper in a former Journal, (vol. iii, page 231,) was supposed by the late Mr. Griffith to be the *Marsdenia tinctoria*.

I remain, &c.

C. B. Taylor.

ACCOUNT OF AN EXHIBITION OF VEGETABLES, HELD AT CUTTACK IN FEBRUARY, 1846. COMMUNICATED BY T. B. MACTIER, ESQ., C. S., SECRETARY, BRANCH SOCIETY OF CUTTACK.

Dear Sir,—I have the pleasure to enclose you the prize list of our last show, as also the annual account of the Society, and regret I have been unavoidably prevented from furnishing you with both sooner. The potatoes sent by Colonel Garnault were far superior to any as yet grown here, they were raised from Nundidroog seed. The show on the whole was better than that in December. The large sum expended in improvements prevented our increasing the sum sent by the Parent Society to be distributed in prizes. For the plan of watering we are indebted to Mr. Brownlow. It is simple, outlay little, and the saving in labor over the plan of open conduits considerable—in the present instance two men do what formerly required three. May I request you to transfer to Messrs. Payne and Co. the share of vegetable and flower seeds, which the Society are good enough to give for the use of the garden here.

As we have still one of the medals sent by the Society remaining, we will not tax their liberality so far this year, but we will be most thankful to receive their annual donation for the shows of 1846-47.

Cuttack : I am, &c.
June 19*th*, 1846. T. B. MACTIER.

P. S.—On looking over my former letter I find, I offered to supply you with cauliflower seed, I regret, however, I am now unable to do so as our garden plants failed.

Cuttack Agri-Horticultural Garden Flower Show, held on the 24*th of February*, 1846.

For the best basket of Flowers, Fruits and Vegetables. The Society's silver medal. Gained by COLONEL GARNAULT.

The best	Peas,	Gained by Mr. Mill's Mallee.
,,	Cabbage,	Capt. Dunlop's ditto.
,,	Beet,	Mr. Gilmore's ditto.
,,	Celery,	Mr. Mill's ditto.
,,	Lettuce,	Col. Garnault's ditto.
,,	Potatoes,	Ditto ditto.
2nd ,,	Ditto,	Mr. Mill's ditto.
,,	Tomatos,	Ditto ditto.
,,	Onions,	Capt. Thompson's do.
1st ,,	Bouquet,	Capt. Rigby's ditto.
2nd ,,	Ditto,	Col. Garnault's ditto.
3rd ,,	Ditto,	Mr. Mactier's ditto.
,,	Artichokes,	Mr. Martin's ditto.
,,	Pumplenose,	Ditto ditto.
,,	Pomegranate,	Ditto ditto.
,,	Papeea,	Ditto ditto.
,,	Pineapple,	Mr. Gilmore's ditto.
,,	Custard-apple,	Mr. Martin's ditto.
,,	Beans,	Mr. Brooke's ditto.

Dr. } *Account of the Secretary with the Subscribers of the Cuttack Horti-Agricultural Garden, from* 1*st May,* 1845 *to* 30*th April,* 1846. { *Cr.*

RECEIPTS.	Rs. A. P.	Rs. A. P.
To Cash Balance on the 1st May, 1845, ...	43 10 10	
Recoverable Balance of 1844-45, ...	12 0 0	
		55 10 10
To Subscriptions.		
Demandable for May, 1845, ...	26 0 0	
" June, "	24 0 0	
" July, "	26 0 0	
" August, "	26 0 0	
" September, "	26 0 0	
" October, "	26 0 0	
" November, "	26 0 0	
" December, "	28 0 0	
" January, 1846, ...	30 0 0	
" February, "	32 0 0	
" March, "	32 0 0	
" April, "	32 0 0	
		331 0 0
To Donations.		
Annual Donation from the Parent Society, ...	50 0 0	
Received from various Residents, ...	65 0 0	
		115 0 0
Sale of Flowers, ...		3 0 0
Total, ...		507 10 10

E. E.

T. B. Mactier,
Secretary, Horti-Agricultural Society.

Cuttack: 11*th May,* 1846.

DISBURSEMENTS.		Rs. A. P.	Rs. A. P.
By Establishment.			
Head gardener per mensem, ...	6 0 0		
Two gardeners at 2-12, three Assistants at 2-8 per mensem, ...	10 4 0		
One boy at 2-4, one at 2, and one at 1-8 per mensem, ...	7 4 0		
		23 8 0	
Eleven months, at above rate, ...		258 8 0	
			282 0 0
Coolies at various times, ...			17 8 0
By Contingencies.			
Postage and banghy hire of seeds, &c., ...		11 3 2	
Gardening implements, flower pots, &c., ...		5 14 0	
Engraving medal, ...		1 0 0	
			18 1 2
By Repairs and Improvements.			
Thatching gardener's house, ...			5 4 0
Making apparatus for raising water, explanation given below,*			80 5 9
By Prizes.			
Awarded at Shows, ...			30 0 0
Total, ...			453 2 9
By Balance.			
Cash in hand, ...		18 8 3	
Recoverable, ...		35 15 10	
			54 8 1
Total, ...			507 10 10

* Watering Apparatus.

Constructing nine circular pucka reservoirs, eight feet in diameter by three feet six inches deep: and laying 946 feet of clay piping to connect, (this is exclusive of the expense of excavations, which was done by the malees attached to the garden.)

APPLICATION OF MOWAH OIL TO ECONOMICAL PURPOSES. COMMUNICATED IN THE FOLLOWING EXTRACT OF A LETTER FROM C. B. TAYLOR, ESQ., DATED 27TH MARCH, 1846.

I take this opportunity to inform you, that I have fully proved the capability of Mowah oil, (Bassia latifolia), being converted to the purpose of making candles and soap, as suggested in my letter to your address of the 27th August last; (Journal, vol. iv, page 211, Correspondence.) I tried the experiment in the month of December last, performing the operation of pressing during the night in order to ensure a sufficient degree of cold. I commenced at 9 P. M., with the thermometer at 60°, and kept the oil until morning under pressure, the thermometer standing at sun-rise at 34° or 35° Fahr. With the stearine so obtained, I made some candles mixed with one-third of mutton fat, and which burnt well, and about as long as a tallow candle would have done; but my press was not at all adapted to the purpose, being nothing more than a long straight piece of wood, tied at one end to a tree, and a weight put at the other end, the oil being enclosed in a bag, and placed near the middle of the lever; there can be little doubt, that with a press of sufficient power, as good stearine could be obtained from the Mowah oil as is now obtained in England from the cocoanut oil, and the former would have the advantage over cocoanut stearine of being edible, and might therefore be used as a substitute for butter—cocoanut oil being unfit for human food.

I propose sending you five or ten maunds of oil, and which the Society can forward to England for the purpose of being made over to any of the manufacturers of oil possessing a stearine press, who would engage to give us a sample of candles and soap made from it; by adopting this course, we shall not only find out the value of the oil for the purposes to which we suppose it may be usefully applied, but at the same time will be making its useful properties known: remember I have little chance of making any thing that would be approved of without being possessed of a proper press, and have merely proved the fact, that it may be applied to the same purposes to which cocoanut and palm oil are now being successfully applied in England.

REPORT OF AN EXHIBITION OF VEGETABLES, FLOWERS, &c., HELD AT BHAUGULPORE, IN JUNE 1846; WITH AN ACCOUNT OF THE PROGRESS OF THE BRANCH SOCIETY AT BHAUGULPORE. COMMUNICATED BY MAJOR T. E. A. NAPLETON, HONORARY SECRETARY.

MY DEAR SIR,—In forwarding to you the accompanying account of our last Agri-Horti. and Floricultural Exhibition, I am requested by our Branch Society to solicit the favor of your laying it before the Parent Society at your next meeting, and to express a hope it may prove satisfactory.

I take this opportunity to inform you, that the cereals you sent me for distribution, (I mean those sent out by the Court of Directors) proved a failure as far as wheat, barley, and tares, but the mangul-wurzul, flax, mustard, rape, and turnip seed germinated freely and yielded excellent crops. The Nerbudda wheat and white linseed* have succeeded admirably, and I shall shortly have the pleasure of forwarding to you a sample of some grown on the farm of Walter Landale, Esq.

If the Parent Society could send us some foreign oats and barley for sowing between the 15th of October and 15th of November, it would be doing us a real and solid service. We have now plenty of ground for agricultural experiments, as you will perceive on a perusal of our "show" report.

I remain, &c.

Bhaugulpore: T. E. A. NAPLETON,
June 16th, 1846. *Honorary Secretary.*

On Monday, the 1st of June 1846, an Exhibition of flowers, fruit and vegetables took place in the Society's new Show Room, and the evening being a delightful one (owing to a heavy shower of rain having fallen just before) the attendance of both the European and Native community was most numerous, and last, though not least, a great number of ladies honored this interesting Meeting with their presence.

Mr. C. Quintin, Mr. F. Tucker, and Mr. W. Landale, having been elected umpires for the fruit and vegetable departments, proceeded with the business of the evening.

* This wheat and linseed were presented by Col. J. R. Ouseley.—EDS.

They first inspected the produce of the Society's Garden, which consisted of three baskets of grapes, one of peaches, one of Bombay mangoes, one of a delicious plum, known by the name of the 'Rungpore plum,' one of plantains, a basket of carrots acclimated from American seed, one of asparagus from English seed, one of onions from Cabool seed, one of leeks, one of cucumbers, one of potatoes from acclimated seed, and several *dallees* of indigenous vegetables. The umpires pronounced the whole of the above fruit and vegetable *dallees* to be exceedingly good and satisfactory.

The competition for prizes amongst the mallees of private gardens next commenced, and money prizes were awarded as follows :—

To the gardener of J. Pontet, Esq. A prize for herbs of sorts, amongst which was some fine English horse-radish.

To the gardener of Baboo Gooroo Churn Mitter. A prize for a basket of mangul-wurzul, as fine perhaps as was ever produced in England, also for potatoes, leeks, &c. &c.

To the gardener of G. F. Brown, Esq. A prize for a basket of fine onions.

To the gardener of Cleveland House. Several small money prizes for a basket of unusually fine leechies, also peaches, and two baskets of superb Bombay mangoes, also for a basket of carrots from English seed, and one of very fine acclimated Cherra Poonjee potatoes.

To the gardener of G. Barnes, Esq., Colgong. A prize for some very fine asparagus.

To the gardener of W. C. Watson, Esq. For a basket of fine peaches.

To the gardener of John Glas, Esq. Two prizes for cucumbers and onions.

To the gardener of — Davies, Esq. A prize for a fine basket of Mazagon mangoes.

To the gardener of G. H. Grant, Esq. For a basket of fine asparagus.

To the gardener of Baboo Gobind Suhoy Sirkaree, Vakeel at Mozuffurpore, and Baboo Bridgebaharee Loll, of the same place, prizes for two baskets of fine leechies which were sent from Tirhoot.

To the gardener of Muddun Tacoor, a large zumindar. A prize for plaintains.

The Floricultural specimens were now examined by Mrs. Barnes, Miss Russell, and Miss Mackinnon, who most kindly consented to be umpires. A splendid bouquet of exotics from the garden of J. Pontet, Esq., was first examined and a prize awarded.

There was a fine show of roses, passion flowers, lilies, verbena, sweet briar, petunias, sweet william, white and pink lagerstrœmia, heliotrope, *cum multis aliis,* and several prizes were awarded to the mallees of Cleveland house garden, of Mr. G. F. Brown, &c. &c.

The' flowor show having ended, tho company adjourned to No. 2 Show Room, to witness the competition in the Agricultural Department for two silver medals* and two money prizes.

The samples of cereals were generally very fine, particularly the acclimated Nerbudda wheat. Mr. P. Onraet, Mr. J. Fitzpatrick, and Baboo Nocoor Chunder Chowdry, Sudder Amoen, were elected umpires, and procoedod to test the musters of grain. The first thing which attracted thoir attention was a superb sample of wheat from the farm of Walter Landale, Esq., of Luttypore. This enterprising Momber and Honorary Joint Secretary of our Society last year importod fifty maunds of Nerbudda wheat.

Tho trial has been most successful, for finer than this acclimated wheat cannot perhaps be found in any country, and the Native zumindars and ryots are quite alive to the benefit which would accrue from introducing this and other foreign cereals generally into this and tho neighboring districts.

The umpires, having completed their inspection of the cereals found on reference to the notes they had taken, that Rajah Oodit Narain Singh, of Aulumnuggur, was the winner of one Silver Medal, tho competition for which was open to both European and Natives, for tho best samples of wheat, barley, oats, white gram, safflower, tobacco, &c. &c.; and the second Medal which was open to the competition of Natives only, was won by Baboo Gooroo Churn Mitter, of Bhaugulpore. A money prize of four Rupees was won by Walter Landale, Esq., for his splendid Nerbudda wheat, and a similar prizo for white linseed was won by George Barnes, Esq. of Colgong.

Before closing this report on cereals, it is but proper to record—

That a sample of very fine acclimated Nerbudda wheat was sent to the Show by John Oman, Esq., of Colgong, and one of white linseed by — Greenwood, Esq., of Monghyr, and ranked high amongst tho samples sent from other farms though they did not win prizes.

Names of new Subscribers since the last Show, hold on the 30th of January, 1846.

Thomas Griffin, Esq., Buxar.

H. V. Hathorn, Esq., Civil Sorvice, Chupprah.

C. B. Quintin, Esq., Civil Service, Monghyr.

T. A. Glover, Esq., Civil Servico, Monghyr.

Captain W. S. Sherwill, 66th Regiment N. I., Monghyr.

J. H. Hastings, Esq., Civil Surgoon, Monghyr.

P. Crump, Esq., Sisownee, Tirhoot.

J. H. Hoskins, Esq., Bhugwanpore, Tirhoot.

R. Ronald, Esq., Dowlutpore, Tirheot.

* These medals were presented by the Parent Society.—Eds.

W. M. Dirom, Esq., Civil Service, Chupprah.
W. C. Baddeley, Esq., Dinechuprah, Tirhoot.
James Wilson, Esq., Kumtoul, Tirhoot.
John Stalkart, Esq., Bheekhunpore, Tirhoot.
R. H. Pittar, Esq., Pyo, Tirhoot.
Ewen Macdonell, Esq., Mooteoharee, Chumparun.
W. E. Harding, Esq., Hernie, Tirhoot.
Henry Fitzpatrick, Esq., Khunjurpore, Bhaugulpore.
William Russell, Esq., Civil Service, Chupprah.
D. Brown, Esq., Belsund, Tirhoot.
J. Watson, Esq., Bhugwanporo, Tirhoot.
A. Crawford, Esq., Rajkhund, Tirhoot.
D. Brodie, Esq., Tewarrah, Tirhoot.
A. Speirs, Esq., Civil Service, Cawnpore.
Dr. Denham, Civil Surgeon, Gyah.
A. G. Wilson, Esq., Deputy Magistrate, Gyah, (Nowada.)
G. Beverly, Esq., Sahebgunj, Rajmehal.
Major Handscomb, Commanding 26th Regiment Light Infantry, Bareilly.
James Barnes, Esq., Chuppur Ghata, Colgong.
C. H. West, Esq., Narrar, Tirhoot.

List of Donations since last Report.

From H. V. Hathorn, Esq., Civil Service, the sum of one hundred Rupees.

From B. H. Hodgson, Esq., Civil Service, Darjeeling, the sum of ten Rupees.

From E. F. Lautour, Esq., Civil Service, Gyah, the sum of twenty-seven Rupees, (2nd Donation.)

From the Honorary Secretary, four bags of white grain and four bags of acclimated Nerbudda wheat.

From J. Pontet, Esq., some seed of a pea indigenous to the Rungpore Hills, and which comes to maturity in the rainy season, and consequently likely to prove a most useful vegetable.

From Captain Charteris, Commanding at Seetapore, some Narcissus roots and a packet of vegetable and flower seeds.

From the Honorary Secretary, a packet of fresh English vegetable seeds.

This opportunity is also taken to notify, that since our last report the following Gentlemen have most kindly consented to undertake the duties of Honorary Joint Secretaries for the districts specified.

T. C. Trotter, Esq., Civil Service, for the whole of Tirhoot.
W. G. Brown, Esq., for the District of Purneah.
W. St. Quintin, Esq., Civil Service, for Sarun.
Captain Burlton, for Buxar.

The Garden Committee takes this opportunity of stating, that since our last report twelve bigghas of ground (for the purpose of making extensive Agricultural experiments) have been added to the Public Garden, three pucka wells sunk and finished, and the following buildings erected :—

A gardener's house, thirty-two by eighteen, with tiled roof. A bullock house, with room for sixteen bullocks, also tiled : and a bungalow which consists of a fine room, forty-six feet by twenty-two, with an eight feet open verandah, (four corners enclosed) on handsome pillars.

This building now contains all the seeds, botanical books, records, &c., belonging to the Society, and the Honorary Secretary's office is held in it.

A carriage drive has also been made through the public garden, and in extent is 1,000 yards, and passes through the centre of the horticultural department.

For the above donations, the continued increase of subscribers, and great support our Branch Institution is receiving, the best and united thanks of our Society are freely offered.

By order of the Garden Committee,

T. E. A. Napleton,
Honorary Secretary, Bhaugulpore Branch A. H. & F. Society.

ON THE RADICAL EXCRETION OF PLANTS.

By Alfred Gyde, Esq., M.R.C.S.E., *Painswick.*

At the present time, some of our most celebrated vegetable physiologists differ in opinion with respect to the offices performed by the roots of plants. Independently of the ordinary functions of the roots, viz., the absorption of water and saline matters from the soil, some physiologists, and with them the late celebrated Professor of Botany, M. de Candolle, believe that plants possess the property of excreting, by their roots substances which are formed in their texture, and which, if retained in them, would be injurious to their healthy growth and development ; this excreted matter is also supposed by them to exert a poisonous influence when absorbed by plants of the same order as those from which the excretions were discharged ; but that, when plants of a different order are grown in succession, the matter excreted by the roots of one plant becomes a source of food to the following.

Hence, they believe, arises the degeneration in quantity and quality of any crop when cultivated for several years in succession on the same land ; and hence, also, they explain the cause of the luxuriance of crops when plants belonging to different natural orders are cultivated in succession, as

in planting wheat after clover, supposing the excretions from the clover roots to be conducive to the growth of the wheat plant.

M. de Candolle, with whom this theory first had its origin, conceived it probable that plants excreted matter from their roots, from M. Brugman's having observed drops of liquid exude from the roots of some plants which he had placed in dry sand, and also from the knowledge that the roots of some classes of plants give off a powerful odour when exposed—of such are the euphorbias and mimosas. These facts, with some others, led him to form his theory of the rotation of crops, which he promulgated in his lectures and in his "Vegetable Physiology."* He believes that "every plant, in ejecting all the moisture that extends to the roots, cannot fail to eject also such particles as do not contribute to nourishment. Thus, when the sap has been spread by circulation throughout the vegetable, elaborated and deprived of a great quantity of water by the leaves, and then redescending, has furnished to the organs all the nourishment it contained, there must be a residence of particles which cannot assimilate with the vegetable, being improper for its nourishment. M. de Candolle asserts "that those particles, after having traversed the whole system without alteration, return to the earth by the roots, and thus render it less proper to sustain a second crop of the same family of vegetables, by accumulating soluble substances they cannot assimilate with it." In like manner he observes "that no animal whatever can be sustained by its own excrement." These opinions of M. de Candolle received a degree of confirmation from the experiments on the roots of plants made by M. Macaire, who, after removing plants from the soil and well washing their roots, placed them in vials containing rain water, and after a time he observed that the water contained evidence of exudation from them. He states that vigorous plants of *Chandrilla muralis*, when their roots are placed in water, vegetate and bloom freely Some of these plants, therefore, were selected by him for experiment, removed from the soil, and their roots placed in water, the plants being replaced by fresh ones every two days. After eight days the water in which these plants vegetated had acquired a yellow tint and strong odour, which much resembled that of opium ; it had also a bitter and rather pungent taste—when added to solution of acetate and subacetate of lead, it precipitated in small brown flakes ; a solution of gelatine was rendered turbid by it ; and, when a portion of the water was evaporated, a brown reddish coloring matter was deposited. Similar experiments were made with other plants, and with nearly the same results. He also endeavored to ascertain at what period of the day or night excretion was most abundantly given off by plants. To attain this information, he placed the roots of kidney-bean plants in water, contained in one vessel during the day, and removed them into another vessel containing

* Published in 1827.

water during the night, and he observed that the greatest quantity of excretion occurred during the day-time. Plants were also made to take up by their roots saline and metallic salts in solution in water; after a given time they were removed, well washed, and were placed in pure water, which, at the expiration of two days, was examined and found to contain traces of the salts previously absorbed. From these and similar experiments he concludes "that most vegetables exude, by their roots, substances injurious to vegetation; 2ndly, That the nature of these substances varies according to the families of the vegetables that produce them; 3rdly, That some, being pungent and resinous, may hurt, and others, being sweet and gummy, may contribute to the nourishment of other vegetables; 4thly, That *these facts tend to confirm the theory of the rotation of crops suggested by M. de Candolle.*" These statements of M. Macaire have been met by counter-statements by M. Braconnot, who admits the existence of organic matter in water in which the roots of some plants are immersed, but attributes it to rupture of their roots, it being very difficult to remove them from the soil without injury. He also washed the soil in which the poppy and some other plants had grown for several successive years, but, besides a solution of saline and earthy matters, he only obtained traces of organic matter, and concludes that, "if organic excretions really take place in the natural state of the plant, they are, as yet, so obscure and little known as to justify the presumption that some other explanation must be given of the general system of rotation."

Other physiologists altogether deny the power of excretion by the roots, and with these are M. Mirbel, who, in speaking of the theory of the excretion of plants, says "that such excretions he (M. de Candolle) supposes to be emanations from the roots—the remains of those juices which the earth and air conjointly supply, and upon which in reality the plant exists. But against even the very fact mentioned by M. de Candolle, in confirmation of his opinion, that opium, strowed upon the ground, kills plants, and renders the soil henceforth unproductive, we may quote the much more apposite fact, that trees (why not, therefore, *a fortiori* corn and grasses) grow and flourish for entire centuries in the midst of excretions from their roots."—"Plants require other elements for their support besides those of assimilation, and never thrive without them; for instance, there is silex in the cane, and there is lime in certain plants whose organization could not be complete without it. The quantity of any such ingredient in a plant is generally very small; but the necessity for it may be presumed absolute. Plants cannot be constituted unless all they require be furnished to them; and, indeed, the same observation will apply to animals:—Deprive a hen of lime, and her egg will have no shell—deprive animals of salt, and you will ruin their powers of digestion." With such conflicting opinions, promulgated by men of such celebrity as M. de Candolle and M. Mirbel, and the influence which clear and defi-

nite information on this subject must exert on the establishment of a correct theory of the rotation of crops, it becomes a matter of importance that the subject be fully and fairly investigated, and that the true functions of the roots of plants be clearly defined. Impressed with this idea, the author, in the year 1842, first commenced the investigation of this interesting subject, and his experiments have been continued to the present time; the mode of conducting the experiments, and the results which he has arrived at, he now begs leave to submit to the Highland and Agricultural Society of Scotland for their consideration.

1st, The inquiry or questions which suggested themselves were as follows: Do plants, or do they not, during their healthy growth, excrete matter from their roots?

If they excrete, is the matter excreted organic or is it inorganic?

If organic, of what does it consist?

If inorganic, what is its composition?

Does the matter excreted by different classes of plants possess properties peculiar to each class?

If so, what is the peculiar property of each?

Is it identical with the sap of the plant, or does it differ?

What is the physiological action of the roots of plants by which excretion takes place?

Have plants the power of excreting by their roots, substances previously absorbed, and which are noxious to them?

Will germination occur, and the growth of plants proceed, after the seeds have been impregnated with noxious matters?

Will seeds germinate and grow in poisoned soils?

Why do plants refuse to grow on some soils, while they grow freely on others?

From the difficulty and uncertainty of removing the roots of plants from the soil, when grown under ordinary circumstances, without injury to the extremities of their fibres, it was found necessary to have recourse to such a mode of growing them that they could have their roots freed from the soil, at any period of their growth, without sustaining injury—this object was attained by growing plants in the following manner:—

1st, In garden soil placed in pots, and plunged in the earth.

2nd, In pots filled with siliceous sand, the growth of the plants being promoted by waterings with weak liquid manure, *i. e.*, dunghill drainings mixed with water, and allowed to become clear before using it.

3rd, In pots filled with siliceous sand, which had been repeatedly washed with boiling water.

4th, In pots filled with damp moss.

5th, In pots filled with coarsely powdered charcoal.

The plants thus grown were wheat, barley, oats, rye, beans, peas, vetches, kidney-beans, (two varieties,) cabbages, mustard, and turnips.

In order to answer the 1st inquiry, "Do plants, or do they not, during their healthy growth, excrete matter from their roots?"—plants of the above kinds were operated upon at different periods of their growth. The experiments were conducted in the following manner:—The roots of the plants, after being removed from the pots in which they had grown, were thoroughly washed by the action of a gentle stream of water, and after being carefully dried on folds of filtering paper, were placed in glasses containing distilled water, which had been exposed to the atmosphere for some days. In this situation the roots were carefully excluded from the light, and kept at as uniform a temperature, of about 55°, as practicable, the green portions of the plant being fully exposed to the action of light and air, the water in the vessels being renewed as it diminished, from absorption by the plant and evaporation from the surface.

TABLE I.—*Experiments on the Order Leguminosæ.*

Plant of	Grown in	Number operated on.	State of Growth of Plants.	State of Health of Plants.	Time Plants retained their healthy appearance.	Color of Water holding Excretion in Solution.	Odour of Water.	Color of dry Excretion.
					Days.			
Beans.	Soil	4	1 foot high	good	8	...	slight	light brown
	Sand No. 2*	5	2 feet ...	good, shewing bloom	10	straw	...	brown
	...	5	1 foot ...	feeble	10	...	very slight	pale brown
	Soil	5	3 feet ...	vigorous seed forming	14	straw	slight	brown
	Sand No. 1	5	2 feet 6 in.	good, in bloom	6	...	...	pale brown
	Soil	4	3 feet high	good, bloom	6	...	...	brown
Peas.	Soil	5	8 inches	good	12	...	...	yellow
	...	5	in bloom	...	6	...	very slight	deep yellow
	...	5	seed formed	...	10	...	...	yellow
	Sand No. 1	5	young	...	10	...	...	...
	...	5	shewing bloom	...	7	...	...	...
	No. 2	5	1 foot high	feeble	10	...	...	...
Vetches.	Soil	10	...	vigorous	10	...	...	traces yellow
	...	10	bloom	...	8	...	...	...
	...	10	seed perfect	...	10	...	...	slight traces
	Sand No. 1	5	young	...	6	...	...	yellow
	...	5	bloom	...	10	...	...	...
Kidney Beans.	Soil	3	young	...	4	...	slight	pale yellow
	...	4	bloom	...	3	...	...	yellow
	Sand No. 1	5	young	good	5	...	...	pale yellow
	...	5	bloom	...	3	...	...	yellow

* The numbers refer to the mode in which the plants were grown.

TABLE II.—*Experiments on the Order Gramineæ.*

Plant of	Grown in	Number operated on.	State of Growth of Plants.	State of Health of Plants.	Time Plants retained their healthy appearance.	Color of Water holding Excretion in Solution.	Odour of Water.	Color of dry Excretion.
					Days.			
Wheat (varieties.)	Soil	5	8 inches	good	12	none	none	pale straw
	...	5	shewing bloom	...	10	...	...	only traces straw
	...	25	seed ripening	...	12	...	...	straw
	Sand No. 1	5	8 inches	...	15	...	...	straw traces
	...	15	shewing bloom	good, but small	12	...	...	...
	Sand No. 2	5	10 inches	feeble	7	...	...	...
Barley.	Soil	7	6 inches	good	15	...	...	pale straw
	...	5	bloom	...	10	...	...	...
	...	26	seed forming	...	17	...	...	...
	Sand No. 1	5	shewing ear	...	10	...	...	traces
	Soil	5	bloom	...	10	...	...	...
Oats.	Soil	5	young	...	10	...	...	pale straw traces
	...	10	bloom	...	8	...	...	
	Sand No. 1	5	shewing ear	...	10	...	...	...
	Soil rich	2	bloom	vigorous	10	...	...	...
Rye.	Soil	5	young	good	10	...	...	...
	Sand	10	bloom	...	10	...	...	...

TABLE III.—*Experiments on the Order Cruciferæ.*

Plant of	Grown in	Number operated on.	State of Growth of Plants.	State of Health of Plants.	Time Plants retained their healthy appearance in water.	Color of Water holding Excretion in Solution.	Odour of Water holding Excretion in Solution.	Color of dry Excretion.
					Days.			
Cabbage.	Soil	2	young	good	3	none	rather strong of the cabbage	very pale yellow
	...	2	half-grown	...	4	...	...	...
	Sand	1	young	...	4	...	slight	traces
	Soil	2	past bloom	...	5	...	rather strong	...
Mustard.	Soil	50	young	...	5	...	slight	pale and slight
	...	40	half-grown	...	6	...	...	slight
	Sand	50	young	...	6	...	...	...
Turnip.	Soil	5	young	...	5	...	...	...
	...	5	bulb forming	...	3	...	like cabbage	very slight pale
	...	5	half-grown	...	3	...	...	...
	[illegible]	[illegible]		...	5	...	...	...

From the above experiments it will be seen that the roots of plants impart to water a portion of soluble matter or excretion, and that this excretion appears to be yielded in greater abundance by plants having large and spongy extremities to their roots, as beans, than by those plants possessed of fine thread-like extremities, as is the case with wheat or cabbages. It will also be observed that, in some instances, the water has acquired an odour which is separable on the application of heat, and may be distilled over when the water is placed in a retort; the plants which impart odour to water, as the bean and cabbage, are also characterized by emitting a similar odour from their leaves. Plants when in bloom were observed to emit a larger portion of excretion than when young or when ripening their seeds; but the amount of excretion obtained, even when many plants were operated upon, was very trifling, seldom being more than a grain in weight when dry.

Of the excretion obtained from the leguminous plants, a portion became insoluble during the evaporation of the water. This result was not observed with any other orders of plants operated on. The matter rendered insoluble by heat was of a brown color, and precipitated in flakes from the water; when dry, it was found to be insoluble in water, but soluble in weak caustic alkalis, yielding a solution of a brown color, from which it was again precipitated on the addition of an acid. The portion which still remained soluble in water yielded a white precipitate with acetate of lead—brown with nitrate of silver—and was rendered turbid on the addition of alcohol: it evidently contained gum or mucilage. When a portion of the excreted matter was heated on platinum foil, it carbonized and emitted the odour of burning grain, and when strongly heated, to burn off the organic portion, a trace of inorganic matter was left on the foil. In order to ascertain the character of this inorganic matter, the excretion from a number of plants was collected and heated in a small platinum dish, until the whole of the organic matter was burned off; the inorganic matter was then moistened with a few drops of distilled water, which dissolved a portion of it. The solution was found to produce an alkaline reaction when applied to litmus paper, first slightly reddened by a very dilute acid. The insoluble portion left on the foil, when touched with a glass rod dipped in dilute hydrochloric acid, was immediately dissolved with the escape of minute bubbles of carbonic acid gas. This solution was divided into two portions on slips of glass, and to one was added a drop of chloride of barium, when the presence of a sulphate was indicated by a white cloud of sulphate of barium. To the other a drop of ammonia was added, and then a drop of oxalate of ammonia, when the presence of lime was indicated. Similar experiments were made on excretion from plants of the order *Gramineæ* and *Cruciferæ*, and in each a portion of inorganic matter was found; the results of the examination being nearly similar to those on the excretion from plants of the order *Leguminosæ*.

In order to ascertain if the soil in which plants had grown contained any portion of excretion, the following experiment was tried:—Sand, which had

been well washed with boiling water, was planted with young beans and peas; these plants were supplied with distilled water, and placed under the most favorable circumstances for healthy vegetation. After they had grown in the sand three weeks, they were removed, and the sand washed with distilled water—filtered—and, on evaporation, it yielded a portion of both organic and inorganic matter, in every respect of a similar character to that obtained by the immersion of the roots in water. Plants of the same kinds to those used in the former experiments were cut from their stems, the lower extremities of which were plunged in distilled water, so that the descending sap, which it was presumed would escape, might be examined and compared with the radical excretions from the same kinds of plants, and it was found that in each instance similar results were obtained on evaporation of the water in which the cut plants had been immersed as those from the water in which the roots of similar plants had excreted. Hence we may conclude that the matter obtained from the roots of plants, or radical excretion, is similar to the sap of the plants from which it was excreted.

The next question which presents itself is the physiological action of the roots of plants by which excretion takes place. The roots of plants are described as the downward prolongation of the stem, as the trunk and branches are the upward development into the air—the spongioles and extremities of the roots being the newest formed and extending portions, and that by these spongioles fluids are taken up from the soil and conveyed into the circulation of the plants.

The fluids thus absorbed are carried by the vessels of the most recently formed wood to the leaves, where, after undergoing certain changes during its exposure to the action of air and light, by which much water is given off by evaporation, the elaborated sap is returned by another set of vessels situated in the inner bark of the tree to the root, supplying during its descent, those constituents necessary for the healthy secretions of the plant.

The sap having arrived in the roots, new fluid is added to it from the soil, and the ascent again commences by the vessels of the new wood, this action continually taking place during the life of the tree, but progressing more rapidly at one season of the year than at another.

Many and ingenious are the theories which have been formed to explain the ascent of the sap. Of these, that which was first pointed out by Detrochet appears most probable, and is now generally received by physiologists. Detrochet found that if, into a glass tube, having one end covered with animal membrane tightly secured over it, a strong solution of salt in water, or sugar in water, be poured, and the end covered with membrane be immersed in a vessel containing water, that in a few hours the liquid within the tube will be found to have risen several feet. This ascent of the liquid in the tube being caused by a portion of the water from the outside of the tube passing through the membrane and mixing with the tube, and at the same time a portion of

the solution will be found mixed with the water outside the tube—this action continuing until both liquids become of the same specific gravity: the former of these actions Detrochet terms *endosmose*, and the latter *exosmose*, and he attributes the action to the effect of electricity.

If we allow the liquid within the tube to represent the sap of the tree—the membrane covering the tube to represent the spongioles of the roots—and the water in which the lower portion of the tube is immersed the water in the soil, we have a combination of circumstances which approach the state of the growing tree, the sap in the tree always being of greater specific gravity than the water surrounding the roots. Under these circumstances there is every probability that a similar action to the one just described is continually going on in the plant during the active period of its growth—water would be taken into the plant through the spongioles of the roots by endosmose, and a portion of the sap would escape into the soil by exosmose, the sap consisting of both organic and inorganic matter in solution in water,* and ever be of greater specific gravity than the water in the soil, arising from the exhalation of water continually going on from the leaves, and consequent concentration of the sap prior to its descent.

But to ascertain by direct experiment how far endosmose and exosmose actually occurs when the living plant is made part of the arrangement, several funnel-shaped glasses were prepared, which would hold about 3 fluid ounces of liquid each, and present $2\frac{1}{2}$ square inches of membraneous substance through which endosmose might take place; these glasses were filled with saline solutions, and also solutions of organic matter, and plants cut from their roots immersed in them through the upper opening, where they were secured by collars of Indian rubber, the portion covered with membrane being immersed in water. In each instance the saline solutions were rapidly absorbed by the plants, they were detected in all parts of their structure, and a portion of the solutions was found to have passed by exosmose into the water in which the membrane was placed. An extract from my note-book will probably place the manner of conducting these experiments in a clear light:—

May 9. Half-past 11 A.M. Temperature in sun 80°. Air dry, endosmose tube, with $2\frac{1}{2}$ square inches of membrane (bladder) filled with half saturated solution of salt and water, in which was placed a young cabbage, cut near the soil, and exposing about 160 square inches of green leaf to the sun's rays, the stem secured by a collar of Indian rubber, and the membrane placed in water.

12·30 Plant evidently drooping.

1·30 Plant drooping much.

2·0 Plant removed. Observation—Two fluid drams of the solution had been absorbed by the plant, and a portion of the salt had passed by exosmose into the water, as proved by adding nitric acid to the water, and testing with a solution of nitrate of silver, chloride of silver being precipitated.

* One gallon of beech sap taken from the tree in the month of May was found by direct experiment to contain

Organic matter dried at 212°, ...	82 grains.
Inorganic matter, ...	22 do.
	104

May 9. Temperature and air as above; mounted endosmose tube as in the former experiment, but used dilute solution of bichromate of potash, and a limb cut from a black currant bush.

May 10. 9 A.M. The whole plant and greater portion of the leaves are impregnated with the bichromate of potash, and six drams of the fluid have been absorbed; exosmose has occurred, and a small portion of carbonic acid gas was found in the tube.

May 10. 10 A.M. Mounted a bean plant in bloom, with solution of prussiate of potash. 4 P.M., the whole plant impregnated with the salt; 3 drams of the liquid absorbed, exosmose had occurred, and a small quantity of carbonic acid gas had escaped from the cut extremity.

May 10. 11 A.M. In a similar manner, a branch cut from a pæony in bloom, mounted with solution of nitrate of iron in endosmose tube. 3 P.M., impregnated with the salt; leaves nearly black; exosmose has occurred, and a gas escaped as before.

May 10. 12 A.M. An endogenous stem, (the flower stalk of the white lily,) divested of leaves, and twenty inches long, placed in endosmose tube, with solution of bichromate of potash.

May 11. 8 A.M. Stem impregnated nineteen inches from the cut extremity.

But in order to imitate, as far as an experiment can be supposed to do, the circumstances under which the plant lives, I mounted, May 30th. 1 P.M., an endosmose apparatus, with sap obtained from the beech, (*Fagus sylvestris,*) and secured in the tube a limb cut from a beech tree, the lower end of the tube being immersed in distilled water. The limb retained its healthy condition nearly a week, at the expiration of which time a portion of organic and inorganic matter was found on analysis to have passed by exosmose into the water. Cut plants were placed in endosmose tubes, with saline solutions of different densities; and plants of the same kind, growing in pots of sand, had the sand well saturated with solutions of the same salts, and it was observed that the solutions reached the leaves in nearly the same time in both instances. Two glass tubes were also filled parallel to their length, the one with cotton and the other with linen threads, forming a series of fine tubes, the sides of which were composed of a similar substance to that composing the stems of plants, the glass representing the bark. These tubes, which were each twenty inches long, were mounted in endosmose tubes, with solutions of bichromate of potash and sulphate of copper respectively. In each case endosmose rapidly occurred, which was evidently facilitated by the capillary nature of the tubes.*

That fluids are, under some circumstances, transmitted through the spongioles of plants into the soil, is placed beyond a doubt, from the following circumstance which was observed during some experiments on standing trees, made in the year 1843. Several beech trees had been prepared according to Dr. Boucherie's plan, for the purpose of impregnating trees with saline and metallic solutions. This consists in making a saw-cut nearly through the tree at its base, into which the solution, by which the tree is to be impregnated by absorption, is made to flow. The experiments had been in progress for some days, when it was observed that trees growing at a distance of from 15 to 20 feet from the trees under treatment were in a drooping state, and quickly perished. This circumstance led to the tracing through the soil a root of a tree under impregnation, and carefully exposing its extremities, which were placed in a glass containing distilled water. In a few hours the

* Layers of paper, (woody fibre.) freed from earthy and saline matter by soaking in dilute acid, and from size by warm water, enclosed between two plates of linen cloth, were found to form an excellent substitute for the animal membrane for the endosmose tube.

water was tested for the metallic solution with which the tree was under impregnation, and it was freely detected in the water as well as in the soil which surrounded the roots. To this cause the death of the surrounding trees was, no doubt, to be attributed ; their roots having absorbed the poisonous solution discharged by the roots of the tree under treatment.

The experiments for the purpose of ascertaining if plants have the power of excreting by their roots substances previously absorbed into their structure, and which are noxious to their growth, are as follows :—The plants selected for these experiments were beans, barley, wheat, and cabbages ; the noxious substances introduced into their structure were in solution in water, and absorbed by the plants through their roots. They were the salts of zinc, copper, mercury, arsenic, lead, chrome, barytes, lime, strontia, magnesia, and soda ; and these were used of strengths varying from five grains of the salt dissolved in one fluid ounce of distilled water to one grain dissolved in two fluid ounces of water. The plants operated upon were in good health, growing in soil, and also on some plants growing in damp moss and sand, as well as plants freed from soil, and their roots plunged in the solutions.

Without further detail of the experiments, the following table will explain the results :—

	Salts used.	Plants.	Grown in.	State Growth.	Effects on.
Zinc.	chloride sulphate	beans cabbages wheat	moss soil ...	half-grown young in bloom	quickly destroyed.
Copper.	sulphate nitrate acetates	beans ... cabbages	... moss soil	half-grown in bloom young	
Mercury.	bichloride	beans wheat cabbages	... ...	... in bloom young	
Arsenic.	arsenious acid arseniate of potash	cabbages and wheat barley cabbages	...	... in bloom ... young	weak solutions did not destroy the plants.
Lead.	acetate	beans	...	...	destroyed after a few days.
Chrome.	bichromate of potash	cabbages beans barley	...	in bloom	destroyed except when very much diluted.
Iron.	nitrate sulphate	beans ...	... ...	in bloom ...	destroyed after some days.
Barium and Barytes.	chloride nitrate	beans cabbages and wheat	moss soil ...	...	quickly destroyed.
Strontia.	nitrate	beans	moss	...	plants unimpaired unless too strong a solution was used.
Lime.	muriate sulphate nitrate	...	... soil moss	...	beans were improved when very diluted.
Magnesia.	sulphate muriate	beans and cabbages	moss moss & soil	...	health impaired, and if strong, destroyed.
Soda and Sodium.	phosphate chloride	... beans	sand & soil	before bloom and in bloom	no injurious action when diluted.

In conducting the above experiments, it was observed that the plants, after absorbing the solution, in most instances either decomposed, or so combined with them, that the salt was in a great measure separated from the water which held it in solution, arising from the affinity between the metallic salts and the woody fibre of the plant. The decomposition of many metallic salts would also be effected by the organic and inorganic constituents of the plants when introduced into their structure in a very diluted state; an instance of which was seen in an oak tree that had grown for years near a stream of water occasionally impregnated with sulphate of iron. On felling the tree the wood was found to be black as ebony, the gallic acid of the oak having decomposed the sulphate of iron introduced by the roots into the texture of the tree, and formed the coloring matter of the wood.*

Of the metallic salts, those of arsenic and chrome were least destructive to plants. These salts were accordingly introduced through the soil into plants of barley and cabbages, by administering homœopathic doses of arseniate potash and bichromate of potash, in solution in water. After ten days of such treatment, the arsenic and chrome could be detected by analysis in the structure of the plants. At this time the plants were evidently less healthy than those growing near them; they were now carefully lifted from the soil, their roots well cleansed with water, and replanted in a soil free from any noxious matter, and, after some days of careful watering and shading from the sun, some of the plants recovered and grew. At the expiration of one month from the time the plants had been transplanted, they were removed from the soil and analysed, the result of which was, that the plants were still found to contain traces of arsenic and chrome.

The soil in which the plants had grown, after they were transplanted, was also submitted to chemical examination, but no trace of either salt could be detected.

Plants of beans† which were shewing bloom, had their roots placed in solutions of nitrate of strontia, chloride and nitrate of lime, and phosphate of soda.

The plant grew freely, and removed from the water much of the saline matter. After five days remaining in the respective solutions, they were removed, their roots well washed, and then placed in distilled water. At the expiration of five days from their being placed in water, it was examined for the salts the plants had absorbed, to ascertain if any had been excreted into the water, and traces could be detected after concentration of the water by evaporation—organic matter existed as usual.

* The same result will be produced when oak saw-dust is mixed with a solution of iron.

† Beans were generally selected to try the power of excretion, since they yield the largest amount of excretion to water, and have large and spongy roots, which, if injured, would not pass unobserved.

To ascertain how far plants have the power of excreting by one set of roots matters absorbed by another, the following experiments were made :—Young bean plants, grown in sand, had their roots cleansed and divided into two portions; two test tubes were also placed by the side of each other, the one filled with distilled water and the other with a very dilute solution of bichromate of potash : into each tube one portion of the roots was placed, and the plant allowed to vegetate for four days; at the expiration of which time the water was examined for the chromate, but no trace of it could be detected. Solution of acetate of lead was substituted for the chromate, and other bean plants introduced, but the result was the same as in the former experiment. Seeds of wheat, barley, and pease, were steeped for thirty-six hours in the following solutions :—

Steep No 1.—5	grains of arseniate of potash to one ounce of water.			
	do.	of bichromate of potash to	do.	do.
,, No. 2.—2	grains of arseniate of potash to		do.	do.
	do.	of bichromate of potash to	do.	do.
,, No. 3.—1	grain of arseniate of potash to		do.	do.
	do.	of bichromate of potash to	do.	do.

The seeds, after being removed from the steeps, were planted in a garden soil. Those impregnated with steep No. 1 all perished; part of the seeds from No. 2 vegetated feebly, but afterwards perished; the seeds from steep No. 3 vegetated well. These plants, after growing to the height of one foot, were taken up, washed, dried and examined for the salts with which the seeds had been impregnated, and traces were detected.

Seeds were also planted in soils mixed with arsenious acid and chromate of potash, for the purpose of ascertaining if the plants would grow in poisoned soils, but by far the larger portion of the seeds perished before the plants made their appearance above the soil; the remainder appeared very unhealthy, and perished before the first leaves were fairly developed.

In order to ascertain the effects of excretion when applied to the roots of plants, the following experiment was made. Ten bean plants were selected and watered once every week from the time they were six inches high, until ripening the seed, with water holding excretion from beans in solution. Ten other bean plants, in every respect similar, were watered during the same period, and in the same manner, with water in which bean plants had been bruised and macerated, while ten more bean plants were watered with rain-water in the same quantities and at the same time as in the two former experiments, the state of growth and health of the whole number of plants was compared once every week until the plants were fully ripe, and if either set of plants were inferior to the others it was the ten to which rain-water had been applied. That the produce of the wheat crop, both in quantity and quality, is *not impaired* by excretion when grown year by year in the same soil must be admitted by every person conversant with the manner in which

wheat was formerly and is now too often, cultivated in the northern states of America; but the following statement of the produce obtained from one acre of land, sown with wheat year after year since the year 1832 to the present time, will be sufficient proof that the excretion from the roots have not exerted any very injurious action on the crop. The piece of land on which the experiment was made, and is still in progress, is situated in the county of Gloucester. It was dug in 1832, burned and sown with wheat, since which time it has received an occasional light dressing of manure, the stubble generally being burned, and the ashes spread on the land.

The produce of the acre is as follows:—

			Bushels.	Gallons.	Quarts.
Produced in	1833,	best corn,	50	1	0
Do.	1834,	do.	34	1	3
Do.	1835,	do.	49	1	6
Do.	1836,	do.	37	2	2
Do.	1837,	do.	20	3	6
Do.	1838,	do.	21	2	5
Do.	1839,	do.	27	3	6
Do.	1840,	do.	30	2	7
Do.	1841,	do.	26	2	1
Do.	1842,	do.	21	0	1
Do.	1843,	do.	37	1	4
Do.	1844,	do.	32	0	4

The crop of the year 1845 has not yet been thrashed out, but, as far as an opinion can be formed by inspection, it is not inferior to any former year's crop.

We have seen, in the preceding experiments, that plants are *not injured* by the application of excrementary matter to their roots. Why, then, is it necessary, under ordinary circumstances, to grow plants in rotation, in order to prevent their degeneration? The answer to such a question will be found in an inquiry into the composition of plants. If we submit to a chemical examination any perfect plant, we find the elements of which it consists may be referred to two distinct classes of matter: the one which is capable of dispersion by heat and constitutes the organic portion; the other fixed and incapable of destruction by fire. The former of these, the organic portion, consists of oxygen, hydrogen, and carbon, and a small quantity of nitrogen,—these are obtained from the atmosphere, from water, and from salts of ammonia and nitric acid. The latter, or inorganic portion, usually constitutes but a small per-centage of the entire plant, and consists of earths, alkalis, and metallic oxides, which from their situation in the texture of the plant, assist in giving firmness and stability to the vegetable structure, and, probably, perform important offices in the vegetable, but yet imperfectly understood. These substances are obtained from the soil, and are conveyed into the structure of plants by the agency of water.

The inorganic portion of one class of plants is found, on analysis, to differ widely in composition from that of plants of a different natural order, so much so, that the commonly cultivated plants may be classified, according to their mineral constituents, thus—We find that wheat, barley, oat, and rye plants, abound in silex, but contain little lime and magnesia ; that tobacco, pease, sainfoin, bean, and clover plants, contain large proportions of the salts of lime and magnesia, and only a little silex ; whilst a third class of plants contain potash as there principal inorganic constituent, and are comparatively deficient in the salts of lime, silex, and magnesia—of these turnip, beet, and potato plants, are those most commonly cultivated. The necessity of these salts to constitute healthy plants may be considered absolute, since we always find them present in their structure. Hence, we may conclude that, whichever class of plants are to be cultivated, the inorganic constituents required by them must be present in the soil, and must also be in such a state that they may be taken up into the structure of the plant, or healthy vegetation cannot be maintained. Of these constituents, the most important are potash, soda, lime, magnesia, phosphoric acid, sulphuric acid, and chlorine. These substances, under most circumstances are found to be present only in very minute quantities, even in fertile soils, yet they all exist in appreciable quantities in soils capable of producing healthy and vigorous plants. On the contrary, such soils as are deficient in these constituents are invariably barren. The fertility of soils is influenced by several circumstances besides the presence or absence of these minute portions of earthy or saline constituents, of such are the mechanical texture, depth, the presence or absence of water, elevation above the sea's level, or the existence of such substances as are noxious to the developments of the plants it is intended to cultivate ; but when no such circumstances occur to impede or impair the full performance of the functions of the roots of plants, and those substances required as food by them exist in such a state as to supply their demands, such a soil is capable of producing any crop it is required to bear. In the newly settled states of North America, and in some of our alluvial soils, we have abundant instances of the powers of the land to produce the finest crops of corn or maize year after year, without the addition of manure, and without any apparent diminution in quantity or quality of the crop. But, under this mode of cropping, a time must arrive when the soil will cease to return its accustomed produce —when it will no longer yield to the plant a sufficiency of those earthy and saline constituents necessary for its full development ; and when this time shall have arrived, the soil can only be rendered productive by restoring, in the shape of manure, those constituents the repeated cropping has deprived it of. But soils that do not contain those constituents necessary to supply the full demands of every crop which may be planted, may yet produce one class of plants in much greater perfection than another : thus, in natural forests, we find the fir, the pine, and the beech, elect to grow on thin dry,

and sandy soils, containing lime, where the oak, ash, and [illegible] ...ld perish, the latter trees preferring a deep clay or loamy soil containing the alkalis, potash and soda, in greater abundance than could possibly be supplied by the soil on which the beech and pine flourish.

Soils containing lime are also characterised by the appearance of leguminous plants as weeds, such are the darnel, the vetch, and the tare—plants that are rarely seen in soils deficient in lime. The *(Erica)* heaths, on sandy soils, and the *(Equisetum)* mares-tails, in the marsh lands, are a marked indication of abundance of silex and deficiency of lime, while the sand-worts and salt-worts indicate the presence of salt in the soil, as is seen on our sea-coasts. Hence soil so constituted would bring to the greatest perfection such crops as would appear indigenous to them from plants of the same natural order electing to grow thereon, while plants of a different natural order would scarcely find sufficient nourishment for their development, and would produce a plant of an unhealthy character, from the fact that the plant is unable to find in the soil those inorganic substances which are absolutely necessary to supply its wants. "A soil," says Sprengel, "is often neither too heavy nor too light, neither too wet nor too dry, neither too cold nor too warm, neither too fine nor too coarse; lies neither too high nor too low, is situated in a propitious climate, is found to consist of a well-proportioned mixture of clayey and sandy particles, contains an average quantity of vegetable matter, and has the benefit of a warm aspect and favoring slope." It has all the advantages, in short, which physical condition and climate can give it, and yet it is unproductive. And why? Because, answer chemical analyses, it is destitute of certain mineral constituents which plants require for their daily food.

From the experiments above detailed, the author draws the following conclusions:—

1st, That the commonly cultivated plants of the natural orders, graminæ, leguminosæ, and cruciferæ, excrete by their roots soluble matters.

2nd, That the excretions consist of both organic and inorganic matters.

3rd, That the organic portion principally consists of oxygen, hydrogen, and carbon, existing as gum and mucilage, and in some plants also of a volatile matter, or oil, possessing the odour of the plant from which the excretion is obtained.

4th, That the inorganic matter consists of saline and earthy salts, having an alkaline reaction, and containing lime, sulphuric acid and chlorine, with potash or soda.

5th, That the quantity of excretion thrown off by any single plant is very small, and excretion can only be satisfactorily examined when collected from a number of plants.

6th, That plants having large and spongy extremities to their roots yield more excretion than plants which have slender thread-like roots.

7th, That the excreted matter is similar in its composition and reaction with test to the sap of the plants from which the excretion is obtained.

8th, That the probable cause of excretion from the roots of plants depends on an exosmose action, which goes on simultaneously with the absorption of water and saline matter by the spongioles of the roots.

9th, That plants absorb metallic salts when in solution in water, and that they quickly die unless the solutions are very largely diluted.

10th, That the salts of barytes are equally injurious to vegetables when taken into their texture as the metallic salts, but that those of strontia, lime, magnesia, and the alkalis, do not act as poison unless the solutions are comparatively strong.

11th, That plants, after the absorption of metallic salts by their roots, excrete in some instances traces of them, but they are more generally decomposed in the structure of the plant and retained.

12th, That seeds impregnated with poisonous substances may germinate if the quantity of the poison be very minute, but in most cases the seeds perish.

13th, That plants are not injured by the excretion, being reabsorbed into their structure, as was supposed by M. de Candolle.

14th, That the necessity for a rotation of crops arises from the soil in most instances being unable to supply those earthy and saline constituents required by plants.

ON THE STEEPING OF SEEDS IN SULPHURIC ACID.

In the summer of 1844 I received a communication from Mr. George Dalziell, Holm of Drumlanrig, informing me that he had tried the steeping of seed-barley in diluted sulphuric acid before sowing it, with, as it then appeared, a very marked effect on the luxuriance of the crop. In August 1845, in answer to my inquiries, he farther informed me, "that the difference was very marked in all the stages of growth, and that, in the end, *the quantity per Scotch acre was eight bushels more on the land sown with the steeped than in that sown with the unsteeped grain.*"

This fact is a very curious one, and I publish it now in the hope that, during the present season, the experiment may be repeated on other soils, in other districts, by different parties, and on different varieties of barley, and the results communicated to the public either through the Association or otherwise.

But this experiment of Mr Dalziell, though no doubt original on his part, is not the only one which has been made in regard to the effect of acid steeps in promoting the growth of corn.

In the account of the eighth annual meeting of the German agriculturists at Munich, in 1844,* I find an account of experiments made in Silesia by Tinzmann, to the following effect :—

Barley steeped six hours in sulphuric or muriatic acids, diluted with forty waters—about 5 lb. of acid per acre—*gave one-fourth more grain and straw.* Steeping in pure water gave more straw, but a very slight increase of grain. The same quantity of acid diluted with water, and sprinkled over the ground before sowing, gave very little increase.

When diluted with forty waters, the sulphuric acid browned the outside of the grain, but did not prevent its growing well; it ought, however, for safety, to be diluted with fifty or sixty times its weight of water.

Tinzmann also tried the sulphuric and muriatic acids upon wheat, oats, and vetches, and upon turnip† and grass seeds, and states that, in all cases, he found the steeped seeds, especially when sulphuric acid was used, do better than the unsteeped. He adds, however, that the acid must be used with precaution, that wonders are not to be expected from it on poor exhausted soils, and that it is on soils which have been long in good cultivation that its effects are most observable.

SUGGESTIONS FOR EXPERIMENTS ON THE STEEPING OF SEED BARLEY.

The experiment suggested by the preceding article may be made more interesting by making along with it a series of other experiments upon steeping, which are connected with points of practical and physiological interest. Thus :

1°. In a previous article, (XIII.,) I have stated that when barley is steeped for the purpose of malting, the water, which is several times renewed, extracts from it a considerable proportion both of organic and of inorganic matter. The inorganic part of the extract is rich in alkaline matter and in phosphates, all of which must be lost to the seed, and yet it sprouts well in the hands of the maltster notwithstanding. Is the saline matter which the grain thus loses necessary to its healthy or perfect condition? Is it necessary to its growth in ordinary soils? Is it a provision of nature by which a store of these substances is laid up in the seed above what is required for its own perfect development, with the view of meeting the emergency of its being placed in a soil in which these substances are unusually deficient? Or are we to consider as only accidentally present the saline and other compounds which are thus easily extracted from it by simple steeping in water?

These are interesting questions, especially to the chemical physiologist, and it would be very interesting to solve them. If the seeds sprout and the plants grow as well, and yield as good a crop on all soils, after these salts are extracted by water, as when the unsteeped seed is sown, or seed steeped only in so

* Bericht über die achte Versammlung Teutscher Land und Först wirthe zu Munchen von 30th Sept. bis 7 Oct. 1844, p. 244.

† An anonymous correspondent, who some time ago requested me to turn my attention to the steeping of turnip seed, may take a hint from Tinzmann's experiments.

much water as it can absorb, then we may infer that what the water extracts is not necessary, and that the seed would perform all its natural functions as well without their presence. In that case we should be justified in concluding that they formed no part of the necessary and natural constitution of a healthy seed.

2°. But if, on the other hand, the seed thus exhausted by water grows less vigorously and yields a small return, then we should be justified in concluding, not only that these saline mattors which water extracts are really necessary to the perfection of the seed, but of inquiring whether the seed might not with advantage be provided with a larger portion—be beneficially steeped, that is, in a solution which would still further charge it with theso saline substances, before it was committed to the soil.

Tho answor to this inquiry would be obtained by steeping the grain in a solution containing the same or similar substancos to those naturally present in tho perfect seed. Such a steep would be obtained by the use of a mixture consisting of phosphate of soda, sulphate of magnosia, nitrate of potash, common salt, and sulphate of ammonia. One pound of each of these substances dissolved in 10 gallons of water, will bo sufficient to stoep 300 lbs. of seed, which may remain in the solution from 30 to 50 hours, and should be afterwards dried with gypsum or quick lime.

The quantity of salino matter above prescribed is sufficient to impregnate tho grain with an additional portion equal to that which it naturally contains.

3°. It is possible that after the grain has been extracted by water, it may again be impregnated beneficially with an artificial saline solution, such as that above described, or by a solution of one of the substances only of which the mixture is composed—of nitrate or phosphate of soda, for example, or of sulphate of soda.

Most of those experiments bear more or less directly upon practical operations, but they are especially interesting to the physiologist. I would, therefore, venture to suggest to such of tho members of tho Association as can appreciate the beauty and importance of such inquiries, that advantago might be derived, and considerable knowledge obtained, by the careful performance of such a series of experiments as the following upon the steeping of barley :—

Seed steeped and washed in repeated waters.	Steeped in as much water only as it can absorb.	Steeped in diluted sulphuric acid. (Art. xxv.)
Steeped in diluted muriatic acid. (Art. xxv.)	Steeped in mixed saline solutions as above.	Steeped first in water and then again in the mixed saline solution.
Seed steeped in nitrate or phosphate of soda.	Steeped first in water, and then in nitrate or phosphate of soda	Dry unsteeped grain.

I am certain that some of these exporiments, at least, will be attended to by the cultivators of scientific agriculture during the ensuing season.—*(Transactions of the Highland Society of Scotland. March,* 1846.*)*

ANALYSES OF THE ASHES OF SUGAR-CANES FROM THE WEST INDIES. BY JOHN STENHOUSE, PH.D.

Within the last few years, it has been satisfactorily ascertained, through the labors of the ablest experimenters in agriculture, that the fertility of a soil is dependent on its containing certain mineral substances which are indispensable to the nourishment and full development of the plants which grow upon its surface. It is evident therefore that a knowledge of the constituents of the ashes of plants, as furnishing us with a view of all the inorganic substances which they derive from the soil, and which they remove from it in harvest, must always be of the utmost importance for the guidance of the scientific agriculturist. During the last three or four years, the ashes of the larger number of our cultivated plants have been subjected to very careful analysis, chiefly through the exertions of Professor Liebig and his scholars.

As hitherto, however, the sugar-cane has been almost entirely overlooked, I was induced, some six months ago, to apply to some of the leading colonial proprietors to furnish me with specimens of canes from different localities. I need scarcely say that my request was most courteously and promptly complied with. The following are the results of twelve analyses of the ashes of sugar-canes from various localities in the West Indies.

The first table (*A*) contains the results of these analyses, in which, after the insoluble matter consisting of coal and sand, and the loss (iron), have been abstracted, the constituents are calculated in the relative proportions per cent which they bear to each other. In the table *A*. an error has been committed, by calculating that portion of the sodium and potassium which undoubtedly existed in the canes in the state of chlorides, as potassa and soda, thus introducing an excess of oxygen, amounting in Nos. 3, 9 and 10 to 2 per cent, and in No. 8, to almost 4 per cent. To remedy this error, a second table (*B*) has been constructed, in which that portion of the potassium and sodium, which in the canes are united to chlorine, are calculated as chlorides.

A. Per-centic results after abstracting the charcoal and sand.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	
Silica	45·78	42·81	45·50	40·85	46·24	49·71	44·68	17·04	25·78	51·93	47·79	54·22
Phosphoric acid	3·75	7·97	8·16	4·53	8·12	6·53	4·84	7·12	6·06	13·28	2·85	7·96
Sulphuric acid ...	6·64	10·92	4·56	10·80	7·48	6·37	7·67	7·70	5·94	3·30	5·25	1·91
Chlorine	2·70	1·02	8·85	5·47	2·39	2·36	4·34	14·33	9·70	2·40	8·75	2·70
Lime	9·13	13·17	8·73	8·96	5·75	5·07	4·45	2·26	5·74	10·59	11·40	14·27
Magnesia ...	3·65	9·86	4·41	6·84	15·53	12·94	11·78	3·80	5 36	5·6[illegible]	5·51	5·27
Potash	27·32	11·99	15·00	21·39	11·87	13·62	16·81	39·51	37·40	10·04	17·29	11·59
Soda	1·03	2·26	4·79	1·16	2·62	3 37	5·43	8·24	4·02	2·35	1·16	2·08

B. Contains the results of the same analyses as Tablo *A*., but the chlorine is represented as united to sodium and potassium.

	1.	2.	3.	4.	5.	6.				10.	11.	
Silica	45·97	42·90	46·16	41·37	46·48	50·00	45·13	17·64	28·38		48·73	
Phosphoric acid	3·76	7·99	8·23	4·59	8·18	6·56	4·88	7·37	6·20	13·04	2·90	8·01
Sulphuric acid ...	6·66	10·94	4·65	10·93	7 52	6·40	7·74	7·97	8·08	3.31	5·35	1 93
Lime	9·16	13·20	8·91	9·11	5·78	5·09	4·49	2·34	5·87	10·64	11·62	14·36
Magnesia ...	3·66	9·88	4-50	6·92	15·61	13·01	11·90	3·93	5·48	5·63	5·6	
Potash	25·50	12·01	10·63	15·99	11·93	13·69	16·97	32·93	31·21	10·09	7·46	
Soda	...	1·39	...	...	0·57	1·33	1·64	...	...	0·80		
Chlor. of potass	3·27	...	7·41	8·9	...	...		10·70	11·14	...	16·06	0·84
Chlor. of sodium	2·02	1·69	9·21	2·13	3·95	3·92		17·12	7·84	4 29		3·83

Nos. 1, 2, 3 and 4 were very fine full-grown canes from Trinidad, consisting of stalks and leaves, but without the roots. I am indebted for them to the kindness of Messrs. Eccles and Co. of Glasgow. Nos. 5, 6 and 7 were very similar canes from Berbice, furnished me by James Laing, Esq., from his estates in that colony. No. 8, consisting of the stalks without leaves from Montrose estate, Demerara, was kindly given me by Willian Gourlie, Esq. Jun., No. 9, consisting of full-grown canes with but few leaves, from the island of Grenada, was given me by Mungo Campbell, Esq. Jun., No. 10, from Hampden estate, Trelawny, Jamaica, consisted of transparent canes in full blossom, grown about six miles from the sea, and manured with cattle-dung. No 11, consisted also of transparent canes from Ironshore estate, St. James', Jamaica; they grew about 200 yards from the sea, and were old rattoons, also manured with cattle-dung. No. 12, from Content estate, St. James', Jamaica, were young transparent canes, grown about three and a half miles from the sea, and manured with cattle-dung, guano and marl. For these last three parcels I am indebted to the kindness of William Stirling, Esq. of Kenmure.

The canes after being carefully cleaned were dried in a stove, then charred on a plate of cast iron, and finally incinerated in a Hessian crucible at a very moderate heat, so as to prevent the ashes from melting. The method adopted in these analyses was chiefly that of Messrs. Fresenius and Will, except in regard to the phosphoric acid.

The method of proceeding was as follows :—

I. A quantity of the ash (1 gramme) was boiled with nitric acid, and the filtered liquor was employed to determine the chlorine with nitrate of silver in the usual way.

II. Another quantity (about 1·5 gramme), dissolved in muriatic acid, was employed for the determination of the sulphuric acid.

III. A third quantity (about 5·0 grammes) was boiled in a silver basin for about an hour with a very concentrated lye of caustic soda, to bring the silica into a soluble state, as the ashes were not completely decomposed by boiling with acids. The alkaline mass was then digested with nitric acid, evaporated to dryness, again digested with dilute nitric acid, and filtered. The silica, coal and sand in the insoluble residue were determined in the usual way. The liquor which passed through the filter was employed for the determination of

the phosphoric acid, lime and magnesia. The whole of the liquor was measured in a graduated cylinder.

a. The sulphuric acid was determined in a portion of the liquor by chloride of barium.

b. Another measured quantity of the liquor, after being neutralized by ammonia, was precipitated by acetate of lead, and the phosphoric acid it contained determined according to the method given by Berzelius. The precipitate was well washed with boiling water to free it entirely from chloride of lead, and the sulphate of lead precipitated along with the phosphoric acid was calculated from the quantity of sulphuric acid already found (in III. *a*), and was of course subtracted.

c. The liquor from which the phosphate of lead had been separated (*b*), when freed from lead by sulphuretted hydrogen, and rendered alkaline by ammonia, was employed for the determination of the lime and magnesia, by means of oxalate of ammonia and phosphate of soda in the usual way. In the last five cases the determination of the phosphoric acid was controlled by the process lately recommended by Fresenius with sulphate of magnesia. (See Liebig's *Annalen*, July 1845, and *Chemical Gazette* for October 15.)

IV. A fourth quantity of ashes (about 2.3 grammes) was employed to determine the alkalies. It was digested with an excess of barytes and a little water in a silver basin for about two hours. The alkaline mass was acidified with muriatic acid, and evaporated to dryness. It was then re-dissolved in distilled water, and caustic barytes added to the solution, to precipitate all the phosphoric acid, sulphuric acid, lime and magnesia it contained. The filtered liquor was then freed from barytes by means of carbonate of ammonia, and the clear solution was evaporated to dryness and heated to redness till nothing remained but the chlorides of the fixed alkalies. The potash was separated from the soda by means of chloride of platinum in the usual way.

It is evident, from the results of the analyses contained in the preceding tables, that the sugar-cane, to ensure its successful cultivation, requires to be furnished with a very large quantity of silicate of potash, and also with a considerable amount of the phosphates. In fact, there are few of our cultivated plants, except perhaps wheat, barley and the other Cerealia, which require so large an amount of these substances. It is not wonderful therefore that the cultivation of the sugar-cane, from the inconsiderate way in which it has hitherto been too often conducted, should have been found rapidly to deteriorate, and in the course of time to exhaust most ordinary soils. I apprehend, however, that this exhaustion of the soil by the cultivation of the sugar-cane is by no means an unavoidable result, and that by means of suitable arrangements successive crops of sugar might be raised without the soils being materially injured. Wheat, or any other kind of grain, necessarily causes the removal of a portion of the valuable inorganic constituents of the soil, such as the alkalies, phosphates, &c., which can only be returned to

it indirectly; but with sugar the case is quite otherwise. Sugar is a purely organic substance, consisting of carbon and the elements of water, all of which can be derived from the atmosphere, and contains neither alkalies nor phosphates; so that if the ashes of the canes were carefully collected and returned to the soil in an available state, I do not see why cane crops might not be grown upon the same land almost indefinitely.

Under the present system, however, the crushed canes which have been passed through the sugar-mill to squeeze out the juice they contain, are burned under the coppers of the boiling-house to concentrate the syrup. As this operation requires a strong, brisk fire, the furnace in which they are burned has usually a considerable draught, and therefore so high a heat, that the ashes, from the large amount of alkalies and silica they contain, are invariably fused into a hard, insoluble glass or slag. This slag or glass is usually thrown away, but even if it were pulverized and spread upon the fields, from its almost total insolubility, I apprehend it would be found nearly useless as a manure. The only way to render the cane-ashes available for this purpose, is either to burn the canes in an open fire, at a much lower heat, so as not to fuse them, or, what will probably be found much more advisable in practice, to reduce the slags to a fine powder, and then to fuse them for an hour or so, either in a large iron crucible, or in a reverberatory furnace, with an intimate mixture of one and a half part American black ashes and one of carbonate of soda. This operation, which is by no means either difficult or expensive, has the effect of reconverting the slags into soluble alkaline silicates, and thus rendering them quite available for the nourishment of the canes. After fusion with excess of alkalies, the slags may be readily reduced to powder, and with a small quantity of either bone-dust or guano they will form an excellent manure for either canes or wheat. It is advisable to apply the guano and the fused ashes separately, as the excess of alkali present in the ashes would have the effect of dissipating part of the ammonia of the guano. The ashes of almost any kind of wood, if burned in an open fire, so as not to be melted, would, I believe, be found very beneficial to the sugar-cane, and of course the more potash the ashes contained so much the better.

The fluxing of the cane-ashes with alkalies, just recommended might, I think, be readily effected in most of the colonies themselves, as a great deal of fuel is by no means necessary, and a bright red heat kept up for an hour or so is amply sufficient; but as the quantity of cane-ashes produced on an estate will not exceed a very few tons in a year, probably not more than four or five, if so much, they might perhaps be advantageously sent to Great Britain, where fuel is much cheaper, and then returned to the colonies in a manufactured state.

NOTICES REGARDING EAST INDIAN KINO AND AFRICAN OLIBANUM.

Extract of a Letter from J. Forbes Royle, M. D., *dated India House,* 18*th June,* 1846, *to the Secretary of the Agricultural Society of India.*

"I have the pleasure to send you two little papers, with the Journal in which they are published, respecting two articles of Indian commerce. The *Pterocarpus marsupium,* being diffused over a great extent of Indian territory, others may find it worth while to collect its Kino, for which there would be considerable demand here, as it is of excellent quality."

ON EAST INDIAN KINO.

BY J. FORBES ROYLE, M. D., F. R. S.,

Professor of Materia Medica and Therapeutics in King's College, London.

[*From the* Pharmaceutical Journal *for* May 1846, *Vol. V., No. XI.*]

Kino is well known as an astringent substance in small and shining, brittle, angulated fragments of a deep brown color. It appears to be a natural exudation of some one plant, from the uniformity of its appearance. Several kinds of Kino are however met with in commerce, as well as described in books, as that of *Butea frondosa* from India, at one time acknowledged by the D. C., and which has no doubt been sometimes imported as Kino; Botany Bay Kino produced by *Eucalyptus resinifera,* or Brown Gum tree, at one time acknowledged by the E. C.; a Jamaica and a Columbian Kino are mentioned, and an extract of Rhatany is sometimes enumerated with them: but genuine Kino has been supposed to come from the west coast of Africa, while there is no doubt—and the fact may be easily ascertained by any one making enquiries in the proper channels—that the best is now imported into this country from Bombay.

Kino seems to have been first introduced into European practice by Dr. Fothergill in 1757, in a paper in *Med. Obs. and Enq.* 1, 358, where he states that he was indebted for information respecting it to Dr. Oldfield, and that the substance was obtained from the river Gambia, whence he called it *Gummi rubrum astringens Gambiense.* Previous to this, Moon, in his travels into Africa, mentions a red-gum as issuing from incisions in trees, and which he mistook for Dragon's-blood. Mungo Park discovered that the tree which yielded this substance was call *Pao de Sangue* (blood-tree) by the Portuguese. His specimens were determined by Mr. R. Brown to belong to

Pterocarpus erinaceus, a tree which has since been well figured and fully described in the *Flore de Senegambie.*

P. erinaceus (*Poiret Illust. t.* 602, *f.* 4.,) *L. E.* A tree 40 or 50 feet in height, with the bark exuding a peculiar blackish-colored juice; leaflets 11-15, alternate, ovate, oblong, obtuse or sub-marginate, above smooth, on the under surface covered with dense short tomentum. Flowers yellow; stamen 8-10 monadelphous, or irregularly diadelphous. Legumen orbicular, membraneous, undulate at the margin, and terminated on one side by a sharp point (the base of the style), in the centre covered with stiff bristles; 2-celled or 1-celled, and cell 1-seeded. A native of Senegambia.

The wood of this tree is reddish-colored; when the bark of its trunk or branches is injured, a reddish-colored juice issues, which quickly hardens in the air, becoming of a blackish color. This brilliant, friable, and astringent substance, though like Kino, does not seem to be collected. "Nous ne l'avons pas vu extraire pour les usages pharmaceutiques sur les bords de la Gambie."—*Fl. de Senegambie,* 1. p. 230, t. 54. And no Kino is known to be imported here from the coast of Africa.

The origin of the name Kino has not yet been satisfactorily ascertained. As stated by Dr. Pereira, it was introduced into the *Edingburgh Pharmacopœia,* 1774, as *Gummi kino,* and into the *London Pharmacopœia,* in 1787, as *Ressina kino.* It was described under this designation in the third edition of Lewis's *Materia Medica,* 1784; but in the second edition, 1768, it is described as *Gummi rubrum astringens,* from Gambia. I have long been of opinion that the name was derived from the Indian *kuenee,* or *kini,* applied to a similar exudation from the bark of *Butea frondosa,* of which the Sanscrit name is *Kin-suka.* (*Himal. Bot.* p. 195, and *Proceedings of the Royal Asiatic Society,* p. 50, 24th May, 1838.) The last is the abstract of a paper written on the occasion of some of the gum of the *Butea frondosa* having been sent as *Kino* to the above society from Bombay. That it had also been imported formerly is evident from Dr. Pereira having, several years previous to 1840, found "in the warehouse of an old drug-firm in London, a substance marked 'gummi rubrum astringens,'" which he has told had formerly fetched a very high price. It proved, on comparison with the above specimens, to be *Butea gum.* This, however, is very distinct from the Kino of commerce, which, for many reasons, I was inclined to think, even when this paper was read, was the produce of *Pterocarpus Marsupium;* but so many substances having been called Kino, it was impossible to prove the fact without authentic specimens, though sufficient proof has since been obtained by two independent courses of investigation.

Dr. Pereira states in the first edition of his *Materia Medica,* that what he calls *East Indian Kino* is always regarded in commerce as *genuine gum kino,* and that an experienced East India broker assured him it was the produce of the Malabar coast. Dr. Pereira also traced it to Bombay and to Tel-

licherry, which is on that coast. It may be added in confirmation, from inspecting the official reports of the commerce of Bombay that Kino exported to this country from Bombay had been previously importod from tho Malabar coast to the extent, in 1835-6, of thirty-six hundred-weight. My attontion was again especially turned to this subject on finding in the India House specimens of Kino marked from Anjarakandy, which I recognised as being identical with tho present Kino of commerce. I was unablo for some time to ascertain the locality of Anjarakandy, until informed by Mr. Dyer, the samo who had sent specimens of the Wynaad Gamboge tree to Dr. Roxburgh, that it was tho name of a farm within a few miles of Tellicherry—that is, near the very place to which Dr. Pereira had traced the East Indian Kino.

Having thus determined the place, the next point was to ascertain the plant which yielded this kind of Kino, as well as its mode of preparation. This was affected by writing to Dr. Wight, the distinguished Indian botanist, who was then, as now, stationed at Coimbatore in chargó of the Government Cotton farm. Though he did not at first succeed, Dr. Kennedy afterwards sent him specimens of the flower, leaves, and fruit, also a small portion of the wood and of tho gum, on inspecting which Dr. Wight states, "the specimens received along with the letter, leavo no doubt that the Malabar Kino is the production of Pterocarpus Marsupium." Dr. Kennedy writes that he is informed by his friend, Mr. Brown, of Anjarakandy,* that—

"The juice is extracted when the tree is in blossom, by making longitudinal incisions in tho bark round the trunk of the tree, so as to let the gum oozo down into a receiver formed of a broad leaf so placed and fixed in the bark as to prevent the gum from falling on the ground. From the leaf it is made to run into a receptacle placed under tho leaf to receive the gum. When this receptacle is filled, it is removed, the gum is dried in the sun until it crumbles, and then filled into wooden boxes for exportation."

For this result I was prepared, because Dr. Gibson had already stated, as printed in the above proceedings, p. 59, that "Kino was the produce of *Pterocarpus Marsupium (beula* or *bia)*, a troe very common below the Ghats." The same fact is mentioned on his authority in the Catalogue of Bombay Plants, p. 56, 1839, and also that the Kino is exported in considerable quantities from tho Malabar coast. Dr. Roxburgh, however, was no doubt tho first to direct attention to this tree, which, he states, exudes a red juice, which hardens into a strong, simply astringent brittle gum resin of a dark red color, and strongly resembling that of the Butea frondosa; so that the same analysis might servo for both. He further observes, that the specimen of thè gum Kino tree in the Banksian Herbarium is exceedingly like this

* Since then I have discovered that this was formerly one of the East India Company's plantations under the superintendence of Mr. Brown. It was visited by Dr. Buchanan in January. 1801 *(Journ. in Mysore,* II. p. 544), at a time when, he states, numerous valuable experiments were carrying on in the plantation.

plant. This hardening of the red juice into a brittle dark-colored substance is characteristic of several of the species: as of *P. erinaceus* on the coast of Africa, and of *P. santalinus*, or red sandal-wood, as also in the *P. Draco* of the West India islands, of which the red juice which flows from wounds hardens in a short time.

DESCRIPTION OF THE TREE YIELDING MALABAR KINO.

P. Marsupium, *Roxb.*, is a lofty tree, with the outer coat of the bark brown, the inner red, fibrous and astringent; leaves sub-bifarious, alternate; leaflets 5-7 alternate, elliptic, emarginate, above shining, and of a deep green color, from 3 to 5 inches long. Panicles terminal; petals white with a tinge of yellow, long clawed, all waved or crested on the margins; stamens ten, united into one body near the base, but soon splitting into two bodies of five each. Ovary generally two-celled, legume long-stalked, the under three-fourths orbicular, the upper side straight; the whole surrounded with a waved veined membraneous wing, rugose and woody in the centre, generally one, sometimes two-celled; seed solitary, kidney-shaped. Roxb. *Corm. Pl.* ii., t. 116, published in 1798. *Fl. Ind.* iii., p. 234. A native of the Circar mountains and forests of the Malabar coast; also in the Ghats, between Vellore and Bangalore, and again in those near Coimbatore; apparently also in the forests at the foot of the Himalayas, according to Hamilton, as he mentions it under the name of *Vijaya*, as occurring in the lower woods of Nepal, and also at Kodoya and Gunjuriya, to the eastward of Bengal.*

Dr. A. T. Thomson, many years since, made a series of comparative experiments with different reagents on African, Botany Bay, Jamaica, and East Indian Kino. It is interesting to observe in how many instances the effects on the first and last correspond with the same reagents. This might be expected, supposing the specimens to have been genuine, and the effects of the reagents prove that they were so, because they are proved to be the produce of two species of Pterocarpus.

Dr. Thomson states that *East Indian Kino*, which he also calls *Amboyna Kino*, and which he supposes is produced by *Nauclea Gambir*, is imported in chests, containing from one to two hundred-weight, and that on the inside of the lid of each chest is a paper, inscribed with the name of John Brown, the month and year of its exportation, and stating that it is the produce of Amboyna. This statement made me, when in India, look to the eastward for the Kino of commerce, especially as I knew that there was a Mr. Brown who had the most extensive plantations in the island of Penang.

* *Pterocarpus marsupium* abounds also in the forests of the Palamow district. A fine specimen of its Kino has been lately sent to the Agri-Horticultural Society of India, by a very zealous member and correspondent, Mr. C. B. Taylor, Supt. of the Rajharra Collieries, in that district. Mr. Taylor has likewise sent various specimens of gum, resins and oils, all the produce of the Palamow jungles. (See proceedings of the Society for April and November 1845.) These specimens are deposited in the Society's Museum.—Eds. *Journal A. and H. Society.*

In conclusion, I would suggest, as the name Kino has been applied to so many different substances, that if continued to be used generically it should be restricted to astringent *natural* exudations, while the astringent extracts might all be arranged, as most of them now are, under the head of Catechu. In recapitulation we may observe, that though the original *Gummi rubrum astringens* may have come from the Gambia, it has long ceased to do so. If we admit that the name *Kino* is derived from the Indian *Kuenee* or *Kini*, its place must have been first supplied by the astringent exudation of *Butea frondosa*, which is well calculated to answer all the same purposes, but is not so clean looking; though a very elegant extract in appearance resembling citrate of iron may be prepared from it, as detailed in the accompanying notice by Mr. E. Solly. For many years, however, this Butea Kino has been itself displaced by Kino imported from Bombay, which has been proved to be the produce of *Pterocarpus Marsupium*, as will be further evident from a perusal of the accompanying documents.

FROM DR. WIGHT TO DR. ROYLE.

"*Coimbatore, 19th Nov.*, 1844.

"I did not intend to have troubled you this month, but the arrival this morning of the enclosed note from my friend Dr. Kennedy, on the matter of Malabar Kino, has made me change my mind, so far as to inform you, that the specimens received along with the letter leave no doubt that the Malabar Kino is the production of *Pterocarpus Marsupium.* Brown's name being mentioned as the informant of the mode of extracting it adds vastly to its value."

FROM DR. KENNEDY TO DR. WIGHT.

"*Cannanore, Nov. 15th,* 1844.

"It is a long time since you spoke to me on the Neelgherries about the tree that yields the gum Kino on this coast. I had not, however, forgot your request to me to make inquiries about the tree, and to send you specimens for inspection, but until now I have never fallen in with the tree in blossom. I have much pleasure in acquainting you, that I have this day dispatched per bangy, to your address, a small box containing specimens of the flowers, leaves, and fruit, also a small portion of the wood and of the gum. I trust they may arrive safe, and in such a state as to enable you to make a satisfactory examination; lest the specimens should spoil before they reach you, I have *ventured* to send you a short description of the tree, but for the accuracy of which I will not vouch, as it is many a day ago since I have relinquished my botanical studies. I shall be glad to know that the box arrives safe, and in the event of your requiring more specimens, I will be happy to send them."

DESCRIPTION OF THE KINO TREE OF MALABAR.

Diadelphia Decandria.—Linn.

"A lofty broad-spreading forest tree; leaflets generally five, sometimes six, alternately pinnated, ovate or oval, a small notch at the top, glabrous, upper surface concave and shining; spikes branched; petals four in number, forming a papilionaceous corolla (viz. the vexillum alæ and carina); calyx greenish and slightly tubular, five-toothed; stamens ten, forming a sheath at the base, but divided at the upper part; legume on a stalk varying from one and a half to three inches in length; one-seeded, and surrounded by an irregular roundish membranous wing, having a small pointed delicate spur on the margin; flowers yellow with reddish veins. The tree blossoms in October and November; the bark of the tree is of a greyish color, and is upwards of half an inch in thickness on the trunk. When cut a blood-red juice speedily exudes and trickles down, it soon thickens and becomes hard in the course of fifteen or sixteen hours. The wood of the tree is white, and except at the pith is free from any color. The trunk of the tree from which I took the specimen sent, measured ten and a half feet in circumference—another tree of the kind in the same locality (the cantonment of Cannanore) measured nine feet. I am inclined to believe it is one of the Pterocarpæ. The following account of the mode in which the gum is extracted was given me by my friend Mr. J. Brown, of Anjarakandy:—'The gum is extracted in the season when the tree is in blossom, by making longitudinal incisions in the bark round the trunk of the tree, so as to let the gum ooze down into a receiver formed of a broad leaf so placed and fixed in the bark as to prevent the gum from falling on the ground; from the leaf it is made to run into a receptacle placed under the leaf to receive the gum. When the receptacle is filled, it is removed; the gum is dried in the sun until it crumbles, and then filled in wooden boxes for exportation.'"

"*Cannanore, November* 14*th*, 1844." "J. KENNEDY."

ABSTRACT OF A PAPER ON THE KINO OF BUTEA FRONDOSA.

BY J. F. ROYLE, M.D., V. P. R. S.

[Read before the Committee of Commerce and Agriculture of the Royal Asiatic Society, 24th May, 1838, Proc. p. 50.]

Dr. Royle then read a paper on the astringent exudation of the *Butea frondosa*, premising that any substance of this nature likely to be valuable as an article of commerce, should not only possess valuable properties, but be abundant in nature, therefore cheap, and at the same time not very bulky. The *Dhak* or *Pulas (Butea frondosa)* was one of the most common plants,

either as a tree or shrub, throughout almost every part of India. Its timber was good, but being usually small, only used for fuel; tho ligneous fibres of its roots were employed for rope-making; its flowers yielded a dyo; and from its bark exuded a powerfully astringent gum, while the lac insect frequently settled upon its branches; so that the same laborers might be employed in collecting these various products. Dr. Roxburgh has fully described the red juice which exudes from fissures and incisions in both *Butea frondosa* and *B. superba*, which afterwards hardens into a ruby-colored, brittle, and very astringent gum; but adds, that he was unable to find that the natives made any use of the gum or flowers. Dr. Royle, however, stated that it was well known to, and employed by the Indians in NW. India as a medicine, and was there called *Kumr-kus, Dhak-ka-gond*, and also *Kueni-ka-gond*: and he added, that from the combination of the astringent with tho gummy principle, it was particularly eligiblo in many cases for which astringent medicines were prescribed. It thus probably camo to be called emphatically *Kumr-kus*, or binder of the loins. It had been brought to England, and submitted to him for examination, by Mr. Beckett, who had long resided at Allygurh, in the Northern Doab. Mr. B. hoped that it might prove of sufficient value to become an article of commerce, as it was employed by the natives of N. Western India, for precipitating their indigo. By Col. Galloway it was further stated, that it was likewise employed by them in tanning. The author then proceeded to adduce proofs of this not being a substance which was entirely unknown in Europe; as on comparing it with a reddish-colored astringent gum which he had obtained from his friend Mr. Pereira, it appeared to be identical with it in appearance and properties. This Mr. P. had found in one of the old druggist's warehouses of this city, labelled as *Gummi rubrum astringens*, which it is remarkable was ono of the names by which *kino* was originally known. Somo of this having been sent to M. Guibourt, it was described by him as one of the kinds of Kino, by the name *Gumme astringente de Gambie*, and which he states as having entirely disappeared from commerce, when it was re-discovered by Mr. Pereira, as above mentioned. It is curious, that among the specimens from Bombay, there is somo of this same astringent gum of the *Butea frondosa* which is sent as Kino. This is more filled with impurities, is in smaller pieces and of darker color than that brought by Mr. Beckett; but it is still more closely like the specimen found labelled as *Gummi rubrum astringens*. Tho original Kino having been introduced into pratice by Dr. Fothergill, and called 'Gummi astringens Gambiense,' was ascertained by Park to bo the produce of a *Pterocarpus*, which was named by Mr. Brown, *P. erinaceus*. But as no specimons are to be found of Dr. F.'s original Kino, we are unable to ascertain how much it resembled that of tho *Butea frondosa*. It is curious that Dr. Roxburgh describes an

exudation from *Pterocarpus Marsupium*, in the peninsula of India, as so closely resembling that from the *Butea*, that one description and one analysis, he says, may answer for both. It is very probable, therefore, that the *Butea-Kino* very closely resembled the original *Kino*, the origin of which name M. Guibourt states he has found it impossible to trace; but it is probably not accidental that the name of the *Butea-Kino* is *Kuenee* in N. India, and that its Sanscrit is *Kin-suka*. There can be no doubt, however, that the *Butea-Kino* was one of the original substitutes for the African *Kino*, and was sold at a high price. Had there been a museum of useful Indian products, it probably would never have disappeared from commerce, but would at this day have been extensively imported, instead of being itself supplanted by substitutes from the Eastern Islands, New Holland, South America, and Jamaica. Mr. E. Solly's analysis will probably have the effect of again restoring it to commerce.

Mr. E. Solly described the above exudation of the *Butea frondosa*, as being a transparent brittle substance, of a brilliant ruby-red color, having a very strong astringent taste, and agreeing with the *Kino* of the shops in most particulars, but differing sufficiently to be easily distinguished from it. He detailed a series of experiments undertaken with a view to the separation of its beautiful red-coloring matter, and its application in dyeing. The result of these showed that the color was increased and darkened by exposure to the air; but that whether it was precipitated when in its freshest state, or when the Kino had been exposed to the air for some time, the colors obtained were dingy and undecided, being mostly of a pinkish-grey color. From the careless mode in which the Kino had been collected, it contained from 15 to 25 per cent. of impurities, consisting of wood, bark, small pebbles, and sand. A portion in the crude state, as received from Mr. Beckett, contained about 50 per cent. of tannin, but when purified by simple solution in water, so as to separate the impurities, one hundred parts contained 73.26 parts of tannin, 5.05 of difficultly-soluble extractive, and 21.67 of gum, with gallic acid and other soluble substances. The author stated, that the exact proportion of tannin contained in any specimen of this substance would vary much, according to the mode of collection and time of year at which it was obtained; and recommended its being collected from the trees as soon as it had become hard, and not after it had been exposed to the air, light, and moisture, for some time. Under the latter circumstances, the properties, as was long ago ascertained by Dr. Roxburgh, become somewhat altered, and its value considerably diminished. The probable importance of this substance in tanning leather, was adverted to; and the author concluded by stating, that experiments on its applicability to that art were in progress, and would be detailed on a future occasion.

ON THE TREE YIELDING AFRICAN OLIBANUM.

[*From the* PHARMACEUTICAL JOURNAL *for June*, 1846, *Vol. V., No. XII.*]

(*Read at* 17, *Bloomsbury Square, the* 8*th of April*, 1846.)

THE name *Olibanum* is probably derived from the Greek λιβανος, and this probably from the Hebrew *lebona*, which is very similar to the Arabic *luban*. This word signifies *milk*, and also the juice exuding from a tree, and is applied especially to what used in early times to be called *Thus*, or Frankincense, and more recently *Olibanum*.

The ancients were acquainted with two kinds of Olibanum, one Indian, the other Arabian. The latter was said to be produced in the country they called *Thurifera*. Arrian, in the Periplus of the Erythræan, or Red Sea, mentions Olibanum as exported as well as Myrrh from the coast of Barbaria, which is thought to be the modern Barbera. Avicenna states that it is brought to a town called Merbat, on the sea-coast. "Hôc ex loco multa thuris confecti copia evehitur, quô mercatores negotiantur."* Garcias, writing at Goa, says that no *Thus* is produced in India, and that the whole of what is exported to Portugal is first imported from Arabia. "Confluere eo negotiatores ex Adem (Aden), Xaél [Zeyla of the coast of Africa ?] et aliis Arabiæ locis et cum Rege de Thuris quantitate quam avecturi sint, et de pretio convenire solere, etc. By Pomet, Lemery, and others it is described as of two kinds, male and female. Most authors say that one kind is produced in India, the other in Arabia.

In the Bible we have frequent notices of *lebona* (translated *Incense* and *Frankincense*), which was probably Olibanum, as, like it, it was employed as incense. In a few passages we learn that it was brought from a far country, as in Isaiah lx. 6, "The multitude of camels shall cover thee, the dromedaries of Median and Ephah; all they from Sheba shall come; they shall bring gold and *incense*." So Jerem. vi. 20: "To what purpose cometh there to me, *incense* from Sheba and the sweet cane from a far country?" In the New Testament we have the term λιβανος used. Matthew ii. 11: "And when they were come unto the house, and when they had opened their treasures, they presented unto them gifts; gold, and *frankincense*, and myrrh."

Two kinds of Olibanum are known in commerce, one Indian, the other African.

The Indian is imported in chests, chiefly from Bombay, but also from Calcutta. The place of produce, however, is not well ascertained. Mr. Turnbull, of the Medical Service, many years since sent some resin of the *salai* tree, collected in the hills near Mirzapore, which in the London market

* See the Article *Kondor*, or *Thus*. Avicenna ed. of Pemplius, p. 160.

was recognised as Olibanum. Mr. Colebroke determined that *luban* or Olibanum is produced by a tree called *salai*. I have also collected from the *saleh* tree of the north-west of India, a very fragrant resin which bears a very close resemblance to common Olibanum. This tree is *Boswellia glabra*, *Roxb.*, the former is *B. thurifera* of Colebrooke, called *B. serrata* in many works; but, as Messrs. Wight and Arnott say, "we do not quote here *B. serrata, Stack. ext. Bruc. p.* 19, *t.* 3. The leaves being usually described as ovate, oblong, and acuminated." Both species are contained in Col. Sykes' collection made in the Deccan.

Dr. O'Shaughnessy states, that he has received fine specimens of Olibanum from the Shahabad district, where it is called *Sale gond*, gum of the *Sale* tree; but at Chandalgur, *Gunda berosa*.*

Boswellia thurifera grows to a large size in hilly situations from the coast of Coromandel to central India. It is much branched, but bare of leaves in its lower part, but these are crowded and alternate towards the ends of the branches, unequally pinnate. Leaflets oblong, obtuse, serrated, pubescent. Stipules none. Inflorescence in simple axillary racemes near the ends of the branches, shorter than the leaves. Flowers on short pedicles, of a pinkish-white color. Flowers bi-sexual. Calyx small, five-toothed. Petals five, obovate, tapering to the base, inserted under the margin of the disk; æstivation slightly imbricative. Disk surrounding the base of the ovary, cup-shaped, fleshy, crenulated. Stamens ten, inserted under the disk. Ovary sessile, three-celled, with two ovules in each, attached to the axis. Style terminated by a capitate three-lobed stigma. Fruit capsular, three-angled, three-celled, three-valved, septicidal (splitting at the angles into valves). Seeds solitary in each cell, girded by a membranaceous wing. Cotyledon intricately folded, multifid.

Indian Olibanum, which is now the most esteemed, is in roundish or oblong tears, of a reddish or a light-yellow color, usually covered with whitish powder from attrition of the pieces against each other, translucent within, of a warm bitterish taste, and having a balsamic odour, especially when warmed or burnt. Sp. gr. 1.22. Analysed by Dr. O'Shaughnessy, a fine specimen gave, of resin 37 parts, volatile oil 28 parts, gum 4, gluten 11, in 100 parts; but the quantity of volatile oil is necessarily much less when Olibanum has been exposed to the air, and the resin become dry, which is the state it is usually seen in commerce. Bracannot obtained only 5 per cent. of volatile oil, of resin 56, gum 30, substance like gum 5.2, loss 0.8=100.

The African or Arabian Olibanum is in yellowish tears, and irregular reddish lumps or fragments. The tears are generally ovoid, oblong, or

* The tree *(Boswellia thurifera)* abounds also in the Palamow district, adjoining the district of Shahabad, and lying to the S.E. of it. A very fine specimen of its fragrant resin was presented last year to the Agri-Horticultural Society of India by Mr. Taylor, with the other specimens alluded to at page 112.—Eds. *Journal A. and H. Society.*

rounded, not very brittle, with a dull and waxy fracture, softening in the mouth and bearing much resemblance to mastic, from which, however, they differ in their want of transparency. The reddish masses soften in the hand, have a stronger smell and taste than the tears. Both Lieut. Wellsted and Mr. Johnston state, that large quantities of Olibanum are exported from the Somauli coast.

African Olibanum, known on the continent as *Encens d' Afrique* and *Africanischer Weihrauch*, is imported into Venice and Marseilles from Suez, being obtained from Arabia and the east coast of Africa. Dr. Pereira, who mentions it as African or Arabian Olibanum, describes it as being in smaller tears than the Indian variety, yellowish or reddish, and intermixed with crystals of carbonate of lime. Dr. Malcolmson writes to me from Aden, that large quantities of Olibanum are produced in Africa, principally on the high and extensive range of limestone hills of the Somauli coast, which are in the vicinity of Cape Guardafui. Captain Kempthorne, of the Indian navy, describes the tree which produces frankincense on these hills, at about 1000 feet of elevation in the neighbourhood of Bunder Maryah, and that the Olibanum is carried to the Arabian shore by boats from Maculla. "The tree attains a height of about forty feet, firmly attached to the bare limestone rock, by a thick mass of vegetable substance (part of the tree), which sends roots in the crevices of the rock to an immense depth."—*Malcolmson.* "Captain K. describes the bark as consisting of four different layers. The outermost of all is very thin, and similar to that of the beech. The two next are of a singularly fine texture, resembling oiled letter-paper, perfectly transparent, and of a beautiful amber color. It is used by the Somaulis to write upon. The inner bark of all is about an inch thick, of a dull reddish hue, tough, and not unlike leather, but yielding a strong aromatic perfume. The wood is soft and white. By making a deep incision into the inner rind, the gum exudes profusely, of the color and consistence of milk, but hardening into a mass by exposure to the atmosphere." By this bark, of which he received a specimen from Major Harris, Mr. Bennett, of the British Museum, has been able to identify it as being very similar to that of a tree, of which specimens were collected by Schimper in his Abyssinian journey, on the mountains below Dacheladschezanne. It flowers in December, and ripens its fruit in April. Of this the Abyssinian name is stated to be *makker*. It has been named *Plösslea floribunda* by Endlicher, in *Nov. Stirp. Mus. Vindob., Decad.*, No. 47, and figured in *Iconogr.* t. 129. 130. He has attached it in his *Genera Plantarum*, p. 1073, as an anomalous genus to *Sapindaceæ.*

On seeing the plant, I was instantly struck with its resemblance to a species of Boswellia, and mentioned my opinion to Mr. Bennett that it must be too closely allied to be far separated from it. On comparing the description of the two genera as given by Endlicher himself, I can find no character by

which the one can be justly separated from the other.* The capsule of Plösslea differs in being clavate, but the normal structure of the two is the same. In his *Enchirid. Botanic.*, p. 563, Endlicher mentions "*Plösslea floribundæ*, ex Africæ penetralibus nuper relatæ, ramuli gummi assudato consiti sunt." The specimens in the British Museum are covered with little pellucid tears of a resinous substance, which must be of the nature of Olibanum. I have, moreover, specimens of leaves collected by the late Lieut. Wellsted in the Island of Socotra, which is 200 miles to the eastward of Cape Guardafui. To these leaves a note is attached—"Species of *Uckshai*, found near Rass Dome, about twelve feet high, smooth purple bark, when pierced a white milky substance exudes." These I have always considered to belong to a species of Boswellia, which I temporarily named *B. africana*. Its leaves display indications of resinous exudation. It would be probable, therefore, even without further evidence, that a species of Boswellia might yield the Olibanum of Africa, as *B. thurifera* and *B. glabra* do that of India. This I had long thought probable, as I stated in No. VI. of my *Illustr. of Himalayan Botany*, 1835; "From the affinity in vegetation between parts of Arabia, Persia, and India, it is not impossible but the genus *Boswellia* may extend into other countries, and afford that which is known as Arabian Olibanum," p. 177.

* SAPINDACEÆ. Genus *Anomalum*.	BURSERACEÆ.
PLÖSSLEA, *Endlicher*. Gen. Plant., p. 1073.	BOSWELLIA, *Roxb. Endl.* p. 1135.
Calyx 5-fidus, æqualis.	*Calyx* parvus, 5-dentatus, persistens.
Discus adnatus.	
Corollæ, petala 5, disci basi extus inserta, æqualia, ungue nudo.	*Corollæ* petala 5, sub *disco* annulari carnoso, crenulato inserta, obovato-oblonga, basi angustata, æstivatione subimbricata, sub anthesi patentissima.
Stamina 10, cum petalis inserta.	*Stamina* 10, hypogyna, alterna petalis opposita breviora.
Filamenta libera, subulata.	*Filamenta* subulata, persistentia.
Antheræ introrsæ, biloculares, bassi emarginata insertæ, longitudinaliter dehiscentes.	*Antheræ* introrcæ, biloculares, ovato-oblongæ, basi emarginatæ, longitudinaliter dehiscentes, caducæ.
Ovarium sessile, triloculare.	*Ovarium* sessile, triloculare.
Ovula in loculis gemina, anguli centralis medio inserta, oblique contigua, peltatim amphitropa, micropyle supera.	*Ovula* in loculis gemina, collateralia, pendula.
Stylus terminalis, crassus.	*Stylus* brevis, staminum longitudine.
Stigma depresse subcapitatum, obsolete trilobum.	*Stigma* capitatum trilobum.
Capsula clavata, trilocularis, trivalvis, valvis cum septis alternantibus, columnam tripteram, alis septantem, faciebus seminiferam nudantibus.	*Capsula* drupacea, trigona, trilocularis, septicide trivalvis, valvarum endocarpio subosseo.
Semina in loculis abortu solitaria, triangularia, basi et apice in cuspidem producta, testa ossea, dorso membrana lacerula tecta, umbilico ventrali, nucleum multoties minorem, integumento tenuissimo includente.	*Semina* in loculis abortu solitaria, inversa, compressiuscula, margine membranaceo lato cincta.
Embryonis exalbuminosi leviter arcuati.	*Embryonis* exalbuminosi.
Cotyledones foliaceæ, trilobæ, convolutæ.	*Cotyledones* contortuplicatæ, multifidæ.
Radicula supera.	*Radicula* supera.
Arbor Africæ tropicæ; florescentiæ tempore aphylla, paniculis in apice ramorum confertis, multifloris.	Arbores Indicæ, Elaphrii facie, resiniferæ, balsamifluæ;—racemis axillaribus solitariis, v. terminalibus paniculato-coagestis, bracteolatis, floribus breviter pedicellatis.
Endlicher in *Nov. Stirp. Mus. Vindob. Dec.* N 47.	Roxb. Corom. III. t. 207. Nees, jun. Pl. Off. t. 355. Libanus Colebr. As. Res. IX. 377 c. Ic.

If we, however, compare the information afforded by Captain Kempthorne with that of Dr. Malcolmson, including the fact that large quantities of Olibanum are imported into Aden, and from the Arabian Gulf (which includes the commerce of Africa) into Bombay, there can be no doubt that some of the Olibanum of commerce is produced on the east coast of Africa. If we further consider the identification by Mr. Bennett, of the bark given him by Major Harris with that of the tree called *Plösslea floribunda*, and of the probability of this being nothing but a species of *Boswellia*, we may call it *B. floribunda*. There is every probability therefore that the Olibanum-yielding tree described by Captain Kempthorne is this *Boswellia*, and that it yields one kind of African Olibanum. The only difficulty is in the absence of authentic specimens of the tree and its product to know whether this is identical with what is known both here and on the Continent, as African or Arabian Olibanum.

I cannot conclude without adverting to the many interesting points which are connected with the identification of these ancient objects of commerce. Some of these we find produced in arid and apparently inaccessible countries, which thus, though unfit for the arts of culture, were yet attractive to commerce from producing substances valued by all the earliest civilized nations of antiquity. This was the case with the Myrrh and the Frankincense of the arid and desolate country which extends from the shores of the Red Sea to the Mountains of Abyssinia. By their means, therefore, we are able to trace the routes of ancient commerce and the limits to which it extended. In doing so, we cannot but be surprised that we are only now identifying some of these early-famed products of nature. This is owing partly to the want of curiosity in travellers, and partly to their want of knowledge; but in this respect the older books of travels contain more information than most of those of modern times. The ancients, we find on investigation, had more correct information respecting the sources of some of these substances than is generally supposed, or admitted into ordinary accounts. Thus, though Theophrastus mentions that part of Arabia which is about Saba, Adramata, and Citibæna, and Strabo says that it is in the happy region of the Sabæans that both Myrrh and Frankincense are produced—yet Arrian especially mentions λιβανος as procured with Myrrh at places on the coast of Africa, which probably correspond with the modern Tajoura, Zeyla, and Berbera. So Cosmas, usually called *Indico pleuestes*, as quoted in the volume on Nubia and Abyssinia, p. 117, (in the *Edin. Cab. Library*), says, "the land of frankincense lies at the farthest end of Ethiopia, fifty days' journey from Axum, at no great distance from the ocean, though it does not touch it. The inhabitants of the neighbouring Barbaria, or the country of Sasu, fetch from thence frankincense and other costly spices, which they transport by water to Arabia Felix and India. This country of Sasu is very rich in gold mines." The account might be adduced as a correct one even of the modern commerce.

If we investigate such questions in a scientific point of view, we perceive how frequently species of the same genus of plants secrete similar products. We also perceive that what are sometimes adduced as exceptions to the law, that the products of plants correspond with their structure, may not always prove to be so upon extended investigation. We may hope, also, as in this case, that such investigations may sometimes lead to the extinction of genera of plants which have been so multiplied as to overload the science by the very efforts made for its improvement.* At all events, every fact so ascertained assists in removing the opprobrium which attaches to the history of so many articles of materia medica, as well as of commerce, that we know not whence they are procured, or how they are prepared.

Since this paper was read, and indeed since it has been in type, I find I have been anticipated in referring the genus Plösslea to Boswellia, as on receiving my copy of *Walpers' Repert. Botan. Syst.*, vol. v., and on referring for the account of the new species of Elaphrium, I found on the same page (419) the following, under the head of

"BOSWELLIA, *Roxb.*

"B. (*Amyris. Delile. in Cailliaud Voy. à Meroe Bot.* 99? *Walpers' Repert.* 560 ?) PAPYRIFERA *Hochstett* Flora (B.Z.) xxvi. 91. Arbor cortice papyraceo ; foliis pinnatis 7-8 jugis, foliolis sessilibus lanceolatis crenatis cum petiolo communi tomentoso pubescentibus ; paniculæ ramis racemosis, capsulis clavatis.—Cortex in lamellas latissimas papyraceas secedit, etiam rami floriferi et foliiferi usque ad extremitates, uti resinam suaveolentem thuream exsudant, cortice papyraceo induti sunt. Semina basi et apice cuspidata, subtrigona, dorso lacunoso-gibbosa, ad marginem alæ membranaceæ laceræ fragmentis evidenter cincta quandoque hic margo obsoletus, sæpe tamen latus et valdé conspicuus est præsertim versùs basim seminis.—*Plösslea floribunda*, Endlicher, *Nov. Stirp., decad.* 47, *Iconogr.* t. 119, 120 crescit in Abyssiniâ."

This description, the papery bark and the frankincense-like exudation, will satisfy every one of the similarity of this plant to that described by Kempthorne and Malcolmson, and of the correctness of referring the above remarkable plant to Boswellia, and of the probability of the plant of Delile being the same as that described by Endlicher, which has thus probably a wide distribution.

* I may take this opportunity of adducing another instance of the unnecessary extension of genera in the case of another medicinal plant, that is, the *Dorema Ammoniacum*, described and named by the late Professor Don, and confirmed by Dr. Lindley. Mr. Don's specimens were obtained at Jezud Khast, or Yezd Khast of others—as Capt. Hart, Col. Wright, Major Willock, and Col. Johnson, the last of whom mentions it as occurring also at Majar, but all in places between Shiraz and Ispahan. The late enterprizing traveller and botanical collector, M. Aucher-Eloy, also obtained imperfect specimens between Shiraz and Ispahan (he died at the latter place), as at Yezdichast, and at Majar or Meier. It is not probable that two differ- [illegible]

fect specimens, and these were all the authors unfortunately had in their possession.

Correspondence and Selections.

SUCCESSFUL CULTIVATION OF THE SISSOO TREE IN THE MYSORE TERRITORY.

To the Honorary Secretary Agricultural Society.

SIR,—I am directed to forward copy of a letter from the Secretary to the Government of India, No. 679, of the 8th instant, with enclosure, being a requisition from the Mysore Commissioner for a supply of Sissoo seed, and some cuttings of the China Sugar-cane, and to state that the Deputy Governor would feel obliged if the Society could undertake to procure them.

I have the honor to be, &c.

Fort William: (Signed) CECIL BEADON,
12*th August*, 1846. *Under-Secretary to the Govt. of Bengal.*

[The Society has forwarded to Bangalore, by steamer, viâ Madras, a supply of China cane cuttings, but has not been able to meet the request for Sissoo seed, not having any in store.—EDS.]

To F. J. HALLIDAY, ESQ., *Secretary to the Government of Bengal.*

SIR,—By direction of the President in Council I have the honor to transmit to you, for the information of the Deputy Governor of Bengal, the accompanying copy of a letter from the Commissioner of Mysore, dated 17th ultimo, No. 54, with a request that the application made therein for a supply of Sissoo seed and some cuttings of the China Sugar-cane, may be complied with. I have, &c.

Fort William: (Signed) G. A. BUSHBY,
The 8*th August*, 1846. *Offg. Secretary to the Govt. of India.*

To G. A. BUSHBY, ESQ., *Officiating Secretary to the Govt. of India, Foreign Department, Fort William.*

SIR,—I have the honor to report for the information of the Hon'ble the President in Council, that the experiment of planting the Sissoo in various parts of the Mysore Territory has been attended with such success, as to induce me to request that I may be fur-

nished with a considerable supply of the seed of that valuable tree. The seeds have not been in the ground more than eighteen months, and in some places the trees have already attained a height of twenty feet.

2. It is thus evident, that both soil and climate are well adapted for its growth, and as the passes which have been recently opened through the Ghauts, have rendered the Western parts of Mysore easily accessible from the Sea Coast, it may be hoped that the timber may, in time, be made available for use in other parts of the Peninsula, where the climate is less suited to its production.

3. At page 92 of Dr. Royle's "Essay on the productive resources of India," I find mention made of a species of Sugar-cane originally imported from China, the introduction of which into Mysore, from the peculiar property it is said to possess, of resisting the ravages of the white ants and jackals, as well as being more productive and lasting, would, I conceive, be attended with great advantage to the country. I shall therefore feel greatly obliged by your laying before His Honor in Council, my respectful request, to be supplied, if possible, with some cuttings of the above species of cane.

I have, &c.

Bangalore : (Signed) M. CUBBON,
The 17th July, 1846. *Commissioner.*

UNSUCCESSFUL ATTEMPT FOR THE INTRODUCTION OF CAROLINA PADDY IN THE PROVINCE OF ARRACAN.

To the Honorary Secretary Agricultural and Horticultural Society.

Revenue. SIR,—I am directed by the Hon'ble the Deputy Governor of Bengal, to forward the accompanying copy of a letter from the Commissioner of Arracan, No. 105, dated the 19th ultimo, and to request that you will, with the permission of the Society, furnish for His Honor's information the result of the sowing of that portion of the Carolina seed paddy which was made over to the Society for distribution on the 18th March last.*

* In reply to this query the Secretary intimated, that equally as unfavorable reports had been sent in by Members of the Society. See details in proceedings for December and November.—EDS.

2. To enable the Commissioner of Arracan to continue his endeavors to improve the rice cultivation of the province, the Deputy Governor desires me to request, that the Society will, at the proper season of the year, procure a small quantity of the best kinds of Patna and Bengal seed paddy, (about 50 maunds of each) for shipment to Akyab.

3. His Honor would also be glad to learn whether any Carolina seed paddy is now to be met with in the Calcutta markets, or likely to be so before next sowing season.

I have, &c.

Fort William : CECIL BEADON,
7th October, 1846. *Under-Secretary to the Govt. of Bengal.*

To F. J. HALLIDAY, ESQ., *Secretary to the Government of Bengal.*

SIR,—With reference to the instructions contained in Mr. Under-Secretary Beadon's letter No. 50, of 18th March last, I have the honor to transmit herewith copy of a letter received from Lieutenant and Brevet Captain Phayre, Principal Assistant Commissioner at Akyab, under date the 26th ultimo, reporting the entire failure of the Carolina seed paddy lately imported from America, and I regret to add, that I have received similar reports from the other districts.

2. The paddy reached this some months ago in most excellent condition, and did not appear to have sustained any injury during the voyage. It was therefore distributed in the sanguine expectation, that it would succeed perfectly, but not a single grain seems to have germinated, although it was tried in every possible way.

3. This unforeseen disappointment is supposed to be attributable to the seed having been too old at the time of dispatch, and certainly to no want of care either in the arrangements under which it was procured, or in those by which it was transmitted from place to place, and finally forwarded to me and distributed in this province.

4. I entirely concur with my Assistant in thinking, that we ought not to be discouraged by the failure of this experiment, however expensive it has proved, from further attempts to introduce a superior grain into Arracan. It rarely happens, that any important object is attained without some degree of perseverance, and that this is a very important one is beyond all doubt.

5. But I am not quite certain, that it would be judicious again to send so far as North America for seed grain. Adverting to the fact established by the Straits' price currents, that the rice of Java and Balli sells at Singapore for about double the sum usually realized there on Arracan rice, I am strongly inclined to think, that as the Straits' Settlements are now our greatest markets, it would be expedient to endeavor to procure about two hundred maunds of fresh seed paddy of the above named Islands; and I presume, that this might easily be accomplished at a moderate cost by the Governor of Prince of Wales' Island, and forwarded to me in very good time by one of the many vessels which trade between this and the Straits.

6. I am also of opinion, that as a trade which promises to extend greatly is now springing up between this place and the Islands of Mauritius and Bourbon, and likewise with Great Britain, it would be desirable to have about 200 maunds of the best paddy of Bengal, that from which the Mooghy rice is obtained, sent down from Calcutta; and about 100 maunds of the Patna paddy, which furnishes the beautiful grain known as table rice.

7. It seems only reasonable to suppose, that the above descriptions of grain would be much sought after here as they now are at Calcutta and Singapore, and there does not appear to be any reason why, in a country so peculiarly favorable to the growth of paddy, they should not attain great perfection.

8. One thing very clear as regards the Patna and Bengal grain is, that measures might easily be taken to secure its being of the best possible description for seed, and as it could be sent all the way by steam, it would have every chance of reaching this perfectly fresh; the expense too would be inconsiderable.

9. On the importance of improving the grain of Arracan, I need hardly dilate; what can be more startling than the fact that in one of our principal markets, Java rice sells for just double the price of Arracan! and this for exportation to China, where the demand for food is beyond all calculation! while with Mauritius, where the importation is about ten lacs of maunds per annum, and Bourbon where it is some four or five lacs, this Province has as yet very little trade. How desirable then that Arracan should be in a condition to meet a considerable portion of this vast demand!

10. Of the anxiety of several merchants at those Islands to enter largely into the trade with this Province, I have very frequent proofs in their applications to me for information on various points, and more recently from their assurances that they will this season send many ships. Within the past few weeks two French ships have actually arrived from Bourbon for cargo, which unfortunately they cannot procure, all the rice which the country could spare having been exported last season. It is however, of the first consequence to the permanent prosperity of the Province, that as competition causes price to rise as it has done during the last year or so, by which the rice of Arracan must eventually lose the sole advantage it now possesses, viz. its cheapness, that the quality should be improved. If this can be effected, the prospects of this Province will certainly be very bright. Twelve or thirteen years ago the grain export trade of Akyab, which is still in its infancy, was so trifling, that no note was taken of it. Last season the value of grain exported exceeded twelve lacs of Rupees! and still not above one-third of the land available for paddy on the plains of the Akyab district is as yet cultivated, and even what has been brought under the plough is rarely treated in a careful or skilful manner.

11. I solicit attention to the suggestions contained in the concluding part of Captain Phayre's letter, should it be thought proper to order another supply of seed paddy from America.

I have the honor to be, &c.

Akyab: (Signed) A. Bogle,

19*th September*, 1846. *Commissioner of Arracan.*

To Major A. Bogle, *Commissioner of Arracan.*

Sir,—Agreeably to the instructions conveyed in your letter No. 17, dated 6th May last, I have the honor to state, that I distributed the Carolina paddy seed to all the Keouks in the vicinity of this station, within whose circles the best rice lands are situated. I regret to say, that the report received from each Keouk is of the same tenor, viz.—that upon trial not a single grain germinated. I also have received the same report from Messrs. Brown and Halliday, Merchants of this place. The latter gentleman informs me, he tried it upon both low or wet, and high or (comparatively) dry land, with equal

want of success. I also tried some in my own garden in a dryish soil for Arracan, which would, I imagine, be one more resembling the rice land of Carolina than our ordinary paddy fields would be. These various trials by so many different parties, all failing to make even a single grain sprout, leaves no doubt but the Carolina seed paddy we received was bad. I am far from thinking that we should be discouraged by this failure, on the contrary I strongly recommend, that the experiment be tried again. If I recollect aright, the parties at Charleston, who procured the seed paddy now reported on, spoke of it as a year old at the time of shipment to their correspondents at Philadelphia; I would beg to recommend that the *freshest* paddy seed procurable be sent, and perhaps as an experiment, some smaller parcels of it not exceeding 20℔s. weight each, might be made up and packed more closely than a large barrel could be. The paddy ought to reach this coast by May.

Arracan, P. A. Commr's. Office, I have, &c.
Akyab: (Signed) A. P. Phayre,
The 26th August, 1846. *P. A. Commr.*

[Since the receipt of the above communications, the Government have again addressed the Society, requesting its assistance towards procuring another supply of 500 maunds of Carolina paddy for experiment in Arracan. See proceedings for November.—Eds.]

SATISFACTORY PROGRESS IN SILK CULTURE AT COONOOR, IN THE NEILGHERRIES. COMMUNICATED BY MAJOR F. MINCHIN, OF THE MADRAS ARMY.

To the Secretary Agri-Horticultural Society of India.

Dear Sir,—I shall feel much obliged by your obtaining me a report on the accompanying samples of silk, the produce of our silk farm here.

I did not send a sample to the Madras Horticultural Society this year, as they would not allow Europeans to compete for the prizes.

The accompanying is an ordinary sample and not from picked cocoons, and our chief reelers are the Burghers, the inhabitants of the

Hills whom I have taught to reel. The worms are fed both on the St. Helena and Philippine species of mulberry, and thrive very well, with the help of stoves to regulate the temperature. I send you a sample of each kind, and what we have sent to England has been much approved of, though last year the reeling was much inferior to the present.

The reels I use are the Piedmont muster, but I have only the simple Indian furnaces, though I should like eventually to get a steam apparatus.

From the very high encomium passed lately by the Agri-Horticultural Society of India on the Bangalore silk,* I feel anxious to know whether the Neilgherry silk be not equal in staple.

I have had the trouble and difficulty to surmount of teaching the Hill people to reel, but they are improving rapidly.

I remain, &c.

Coonoor, Neilgherry Hills : F. MINCHIN,
June 18th, 1846. *Major M. Army.*

To the Members of the Silk Committee.

DEAR GENTLEMEN,—I have the pleasure to circulate a letter to my address from Major Minchin, with the specimens of raw silk to which he alludes, for such opinion on its quality, &c. as you may be pleased to afford.

As these specimens appear similar to those received not long ago from the Madras Agricultural Society, you may perhaps wish to compare one with the other. With that object I have put the Bangalore specimens in the box, with your report on them. The box therefore contains—

Two specimens (white and yellow) of Bangalore raw silk, sent by the Madras Society.

The Committee's report thereon.

Two specimens (white and yellow) of Neilgherry raw silk.

Major Minchin's communication thereon.

Your's faithfully,

Metcalfe Hall : JAMES HUME,
15th July, 1845. *Honorary Secretary.*

* See page 26, Correspondence department of this volume.

I think that the report rendered by the Committee upon the Bangalore specimens applies in all respects to these also. The character of the silk is very similar; and the fault of being reeled *too fine* is equally apparent. The thread is too feeble to stand the operation of unwinding by machinery: it should be not less than twice the thickness, and then would still pass as Letter A.

J. W. LAIDLAY.

I concur in what is written above.—R. Watson.

Ditto ditto G. T. F. Speede.

To JAMES HUME, ESQ., *Honorary Secretary Agricultural and Horticultural Society.*

MY DEAR SIR,—Your communication of 17th ultimo, with the specimens of Neilgherry raw silk, has been laid before the Chamber of Commerce.

These specimens very much resemble those from Bangalore submitted on a former occasion, and to them the remarks then made, which need not here be recapitulated, are equally applicable.

In returning the samples I need only further observe, as the opinion of the Chamber, that, were they thicker in the thread, they would be equal to any silk in India. The cocoons have evidently been very superior, and great cleanliness has been observed in the water and reeling; but the thread is far too fine for any ordinary purpose, and it occasionally runs to waste. It should be at least double the present thickness, if not treble. It would then be much more valuable, and strong enough to withstand the action of the machinery in unwinding, without that incessant breakage and heavy loss, incident to silks of feeble staple.

I am, &c.

W. LIMOND,
Secretary.

Chamber of Commerce:
September 16th, 1846.

REPORT BY THE BENGAL CHAMBER OF COMMERCE ON SPECIMENS OF RAW SILK FROM BANGALORE.

[The letter and extract alluded to in the following communication, together with a report from the Silk Committee of the Agri-Horticultural Society, have already been published.—See part I. of this volume, page 23, Correspondence department.—This report from the Chamber of Commerce is now given with the view of rendering the information more complete.—Eds.]

My dear Sir,—I enclose a copy of the Chamber's reply to the reference from Madras, touching the silk samples, which I now return.

To my eye the specimen appears beautiful had the filament been thicker.

Your's truly,
W. Limond.

11*th July*, 1846.

To S. Gabb, Esq., *Secretary Agricultural and Horticultural Society, Madras.*

Sir,—The Honorary Secretary of the Calcutta Agricultural Society has handed to me two sample skeins of raw silk, the produce of Bangalore, and a copy of your letter of 26th February to his address, with extract from Proceedings of a Meeting of your Society, wherein this specimen of the silk is ordered to be sent to the Chamber of Commerce here for report.

Having laid such communication and the samples before the Chamber, I am desired to inform you, that they consider the silk very beautiful, but the thread is too weak for free reeling; if of stouter thread, it would pay well at the price you quote. Both sorts are too fine for ordinary purposes, and could not be rewound without great waste; even twice their thickness might be too fine to suit the English market, the staple not being strong enough to stand the action of the machinery used for winding and preparing the article for the use of the weaver: probably about ten cocoons would afford the best size to reel. The cocoons from which these specimens were made, must have been very good indeed, equal to the best annual cocoons of Bengal; but the thread, especially the white, is endy, and

it is not twisted enough. With improved implements and proper directions, the spinner should be able to produce an article of superior character and higher value.

Though of minor importance, I may here mention, that the skeins would be better if not quite so thick. These weigh about six tolahs, whereas the skeins generally made in India and most approved in England, weigh about three or three and a half of a tolah, a size which is attended with several practical advantages.

Calcutta, I have the honor to be, &c.
Bengal Chamber of Commerce: (Signed) W. LIMOND,
25th April, 1846. *Secretary.*

CORRESPONDENCE ACCOMPANYING A SPECIMEN OF TEA GROWN AND MANUFACTURED BY A CHINAMAN AT JEYPORE, IN UPPER ASSAM.

MY DEAR SIR,—I have the pleasure herewith to forward a small sample of tea prepared by a Chinaman in Assam, to be laid before the Agri-Horticultural Society, for which purpose it was sent to me by Major Jenkins.

Major Jenkins states, that the sample was prepared from a small plantation the man has in his garden. To Major Jenkins it appears of tolerable quality, and I may observe, having tried it myself, that it is the only tea I have seen of this country that might be drank for China tea without discovering any peculiarity of flavor.

Bot. Garden: Your's very truly,
14th October, 1846. J. McCLELLAND.

P. S.—A note from Capt. Hannay, which was enclosed with the package of tea, is herewith sent to the Society.

MY DEAR JENKINS,—By to-day's dâk I have the pleasure to send two small parcels containing samples of *Souchong* tea, made in Jeypoor by one of the Chinamen at the place, who, in his own country-fashion, has made his tea garden, and reaped the first fruits of his labors this year. The tea having been made about three months ago.

I have not tasted the tea in question but others have, and it has been pronounced good, and I have thought it best therefore to send

you the samples; as it may be interesting to you to read the account I have received from the Chinaman, of his expectations in regard to the produce of his tea garden, which is of course managed exactly as if he had been in his own country, the proceeds being intended not for sale but for the use of himself and family.

The plants which produced this tea are from the seeds of China plants, which Government long ago sent up to this place. The plants the Chinaman has, are 700 in number, and have come up from seeds planted in the rains of 1844; at present they are already two years old, and are from eighteen inches to two feet in height.

The space occupied by the tea plants is about thirty-three yards square, and is in fact partly rather an extensive compound, surrounding the Chinamen's houses, which is all under cultivation with various vegetables—nothing in fact that is not useful for themselves or their pigs; the whole is surrounded with a high fence, and the lot of ground is also subdivided by high fences into different compartments, and as there are several large trees, there is of course a good deal of shade: the tea plants are in regular rows, and the ground kept well cleaned, and the earth swept up towards the roots of each plant: the soil—with the exception of a very thin coating, about an inch thick, of darkish vegetable mould, not *artificial*—is the usual red porous soil of these parts, and if one may judge from the flourishing condition of the plants (which are bushy and full of leaves as a healthy rose bush) it must be well adapted; no manure is apparently used, but the ground is kept nearly in as good order and as neat as a pet flower bed.

The plants being now about two years old, eight seers of tea were made from them about three months ago: there are plenty of leaves still remaining fit to be used, but the Chinese have some idea of proper management in this respect; and by leaviug them alone till next year, the produce will be half a maund; and in the fourth year the expected produce will be, if I mistake not, one and a half maund; had it been the Assam plant instead of the China plant, which is small and of slower growth, the produce would have been two-thirds more.

The manipulation of the leaf into tea is of course a very different thing from the cultivation of the plant, which appears, by what I have seen here, a very simple affair, and I cannot see why every

Assamese householder in Muttuck and these parts could not have a poorah or half a poorah of his barree land attached to his house laid out in tea exactly as the Chinamen do at Jeypoor, and the produce carried to the tea factory in the neighbourhood in the same way as the indigo planter gets his plant from the ryots in Bengal; and why should not the Assam Company have given encouragement in this way to the Assamese, giving them plants and seeds to form barrees, or even parcelling out ground for the host of Bengal coolies which have been in Assam, and allowing every house to have so much ground under tea? Their attendance in the indigenous barree would have hardly interfered with the little labor required in keeping 1,000 tea plants clear of weeds at the rear of their own dwellings; and under this system, what an improvement there would have been on the face of the country in the vicinity of the present tea barrees, besides the advantage to the interests of the Tea Company, in having a more extensive field to work upon, instead of being confined to the natural barrees which have now been so *overplucked*, that the produce has probably been at its maximum; and we may assert in fact, if they go on, that there will be an immense falling off, and some of the barrees will likely die off altogether. It is really to be hoped, that if the tea cultivation is undertaken by private individuals, that a different course will be pursued, otherwise it seems impossible that the cultivation, or rather the produce of tea in Assam, will ever come to any thing.

Jeypoor: I am, &c.
9th July, 1846. S. F. HANNAY.

P. S.—You may add to what I have said about the tea plants, that the practise is to plant four seeds in a space about four inches square, and if more than one comes up, they are kept or not according to size and healthiness: with the china plant it matters little if there are two or three plants growing together.

To JAMES HUME, ESQ.

MY DEAR SIR,—I have the pleasure to return the remainder of the tea, having given a portion of it a fair trial. It appears to me to be an excellent strong flavored tea, resembling a superior kind of Congo, and if I had not known it to be from Upper Assam, I should

have taken it for genuine tea from China. I think it is a kind of tea that would sell well in the English market, as they like tea of a strong flavor. I found three tea spoons-full made stronger tea than is generally used.

Calcutta : I am, &c.
22nd October, 1846. (Signed) J. ALLAN.

QUERIES AND REPLIES REGARDING THE PROFITABLE CULTURE OF THE AMERICAN SUMACH (CÆSALPINIA CORIARIA) IN INDIA.

MY DEAR SIR,—I shall esteem it a particular favor if you can procure me information, from any of the mercantile gentlemen who are members of the Society, on the following points—

1. Will the cultivation of the American Sumach on an extensive scale yield a moderate profit?

2. Will a large quantity meet with a ready sale in Calcutta, and what may be calculated on as the probable price?

3. The process of preparing it for the market and the best mode of packing it, and

4. Whether the seeds must be separated from the pods?

5. In what state are the pods to be gathered?

You will much oblige me if you would send me a very small quantity of what is considered the best description of it.

Tavoy : Your's truly,
1st August, 1846. H. MACFARQUHAR.

To JAMES HUME, ESQ., *Secretary Agri-Horticultural Society.*

DEAR SIR,—I have now much pleasure in redeeming the promise I lately made to reply to your note of the 3rd instant at a leisure moment; though I very much fear I shall not be able to give you all the information you require.

Until the American Sumach or Divi-divi plant is very extensively cultivated in this country, it will not, in my opinion, as an article of commerce, yield much or indeed any profit whatever to the growers. The article must be brought to great perfection, and be produced in great abundance, before it can displace the various

substances now used in England and other parts of Europe and America for tanning purposes, such as oak bark, cork tree bark, mimosa bark, valonia, gall nuts, gambier, and kuth or terra japonica. As yet its properties for tanning, or even as a mordant for dyeing have not been properly tested, and consequently remain to be ascertained. But when its utility in both these respects shall have become fully known in Europe and America, I have not the smallest doubt, from the experiments lately made by me and brought to the notice of the Agri-Horticultural Society by Dr. Wallich,* that it will become an article of very extensive and profitable exportation from this country to almost every part of the civilized world.

I do not however think, from my own experience (very limited at present I must admit), that it will, in this country, obtain a preference for tanning purposes over the babool bark, which as I have explained in my correspondence on the subject with Dr. Wallich, has less coloring matter in it than the Divi-divi or country Sumach, and for that reason is preferable as a tannin to the latter.

I am only now for the first time in my life growing the Divi-divi from seeds furnished to me by Dr. Wallich. The seeds were put into the earth in April, 1845 originally in flat shallow earthen pans or gumlahs, and after they had sprouted, the plants when a cubit high, were transplanted to small patches of spare ground upon my premises at Kidderpore, surrounded by brick built walls and godowns. The proximity of these buildings have, I fear, stunted their growth, as I am inclined to think that they will thrive best in an open space without having any enclosure, brick-wall, or buildings of that description near them. Nevertheless, the plants appear in a very healthy condition, and have shot up, some of them, to the height of eight and nine feet, with fine leafy branches spreading out all round them.

I proceed now to the extent of my information to reply to Major Macfarquhar's inquiries, in the order in which that gentleman has stated them.

1st. The reply to this question has been anticipated in the 2nd paragraph of this communication.

* A detail of these experiments will be found in vol. iv, p. 65, Correspondence department.—Eds.

2nd. For the reasons stated by me in the 2nd and 3rd paragraphs of this communication, the article is not likely to meet with very extensive sale in this country, except for purposes of exportation by sea.

3rd. I am not acquainted with the process of preparing the drug for the market, but the Sicily Sumach which I import is brought out packed in air-tight boxes or casks. Atmospheric air should, as far as possible, be excluded from the packages, otherwise the drug is liable to become damp, when it loses much of its strength and essential properties. I found no seeds in the pods which were supplied to me for making experiments by Dr. Wallich. The tannin principle was found to be contained in the pods separated from the seeds.

4th. I think the pods should be gathered when they are full ripe, and my reason for thinking so is, because I have invariably found, that the babool bark, when taken off a full grown tree, is always more astringent and better adapted for tanning purposes than the bark from a young tree.

I understand that an account of the way in which the Divi-divi should be cultivated will be found at page 26 of the 3rd volume of the Society's Transactions. The course I have followed in sowing my Divi-divi seeds was the following—They were sown in broad shallow gumlahs, twenty or thirty seeds in each, filled with light soil, they were sown rather superficially and watered sparingly morning and evening. While the plants were tender they were slightly shaded. When they were about a cubit high, they were taken out and transplanted in the ground at a distance of about 18 feet from one another. While growing, the top and outer branches will require occasionally to be clipped, and the trees themselves to be propped up with sticks, as the trunk is very slender and cannot, without such temporary aid, support the branches that shoot out all round.

Kidderpore: I remain, &c.

28th September, 1846. JOHN TEIL.

REMARKS ON THE USEFUL PROPERTY OF ARISTOLOCHIA INDICA, (ESHURMOOL) AS AN ANTIDOTE TO SNAKE-BITES.

MY DEAR SIR,—I have a vine-creeping plant in my garden, the leaves of which are a *specific* against the poison of snakes. It has been administered in very bad cases on numerous instances with complete success. I enclose a leaf of a medium size, and a few of the seeds, and shall be much obliged if you can give me its name: it grows in the jungles near to nullahs, and is now in flower. The last time I tried it was in the case of a sepoy's wife, the people had tried in vain to charm away the poison, and when the woman became insensible, her husband came over to my gardener to ask for some of the leaves. I sent three, they were reduced to a pulp with water and poured into her mouth, and in half an hour she was quite well—at this time her jaw had dropped, and she was apparently *in articulo mortis.* I have raised a few plants from the seed, but many of the pods were destroyed by a large caterpillar, which was at length driven away by the use of tobacco water and assafœtida.

Allahabad: I am, &c.
16*th August*, 1846. R. LOWTHER.

MY DEAR SIR,—The plant of which you sent me specimens from Mr. Lowther is Aristolochia Indica. The whole tribe are very bitter. In South America, the Guaco remedy for the bite of snakes, is supposed to be one or two species of Aristolochia. Aristolochia trilobata, with an aromatic stem, is used as an antidote to the bite of serpents. Jacques, in his description of American plants, mentions that the juice of Aristolochia anguicida introduced into the mouth of a serpent, stupifies it to such an extent, that it can be handled with impunity: a large quantity causes the reptile to die in convulsions. Three or four species of Aristolochia are also used by the Egyptian jugglers to stupify the snakes they play with. Dr. Royle, in his illustrations of the Flora of the Himalayas, mentions that Aristolochia indica is generally considered by the natives as a cure for snake-bites.

Calcutta: Your's, &c.
August 22*nd*, 1846. WILLIAM MUNRO.

REPORT ON COFFEE GROWN FROM MOCHA STOCK, BY LIEUT. COL. J. R. OUSELEY, AT BURKAGHUR, IN CHOTA NAGPORE.

To James Hume, Esq., *Honorary Secretary Agricultural Society.*

Dear Sir,—I beg to acknowledge the receipt of your letter of the 16th April, and have to announce the safe arrival of two parcels of coffee, weighing together eight pounds. These have been submitted to brokers here of the greatest eminence, and on the other side I hand you their report.

If the experiment is made of sending of this growth to the English market, it is recommended that the quantity should not be less than from 50 to 100 bags, of about a hundred-weight each. Very small parcels never attract attention.

London, East India & China Association : I am, &c.
18*th July*, 1846. J. Stikeman.

Messrs. Trueman and Cook, with compliments to Mr. Stikeman, beg to state, that they have examined the samples of coffee accompanying his note of yesterday's date, and they find its description to be fine, ordinary, coloring, green, mixed with a few pale and unripe berries; flavor delicate, and the berry well made, and somewhat similar to *Mocha ;** value, if imported at the low duty, (that is with certificate) 56 to 58 per cwt. in bond.

No. 40, *Mincing Lane :* 17*th July*, 1846.

Sir,—We have examined and roasted the sample of coffee, which is worth about 54 per cwt. in bond, supposing it subject to the duty of 4*d*. per ℔. This we consider the present worth of it by itself; but as it so much resembles Mocha coffee, especially when roasted, the trade would probably buy it for mixing, and in this case a few shillings more might be obtained.

88, *Great Tower Street :* We are, &c.
17*th July*, 1846. John and Henry Taylor.

* Please observe, that it was not stated to have been the growth of Mocha seed.

THE BAROACH CHURKA—ITS SUPERIORITY TO THE BENGAL CHURKA.

To James Hume, Esq., *Secretary to the Agricultural Society.*

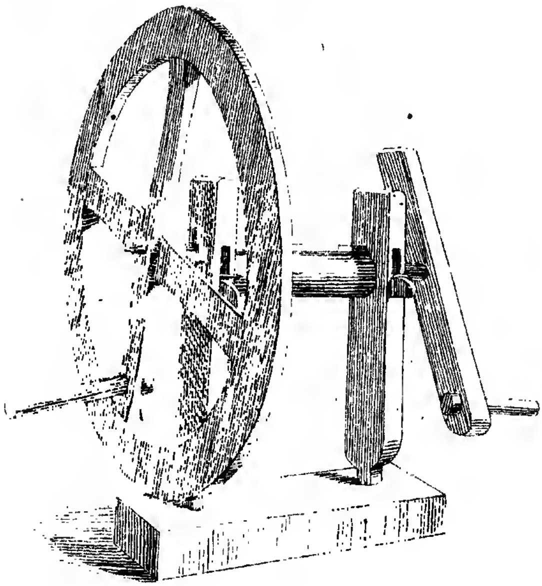
My dear Sir,—I ought to have thanked you for your note of the 27th June last, enclosing an extract of a letter from Dr. Burn, regarding his brother's churka. I have been expecting to see the receipt by the Society of the churka that we might know something more about it and its adaptation to our common cotton.* Where the seeds are loose the American gins appear to answer admirably, but nothing less than the churka will answer with our strongly attached

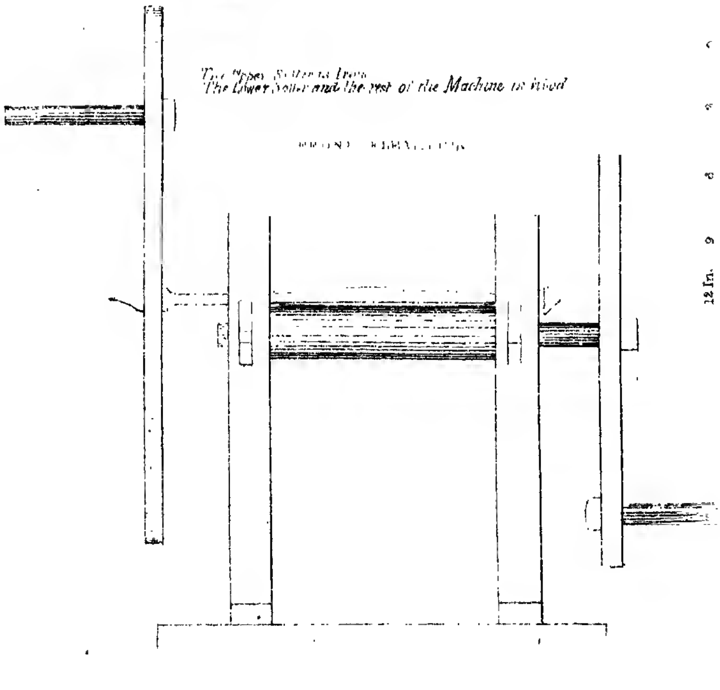
* In accordance with a resolution passed at the general meeting of March last, on the presentation of a letter from Mr. Burn, regarding his improved churka, the Secretary addressed the Government of India, soliciting that the machine in question, now in the possession of the Bombay Government, might be transferred to the Society with a view to its competing for the prize offered by Major Jenkins, for an efficient and serviceable machine for cleaning cotton. It was stated, in reply, that the Government of Bombay had been requested to send the machine, should any favorable opportunity occur. It has not, however, yet reached the Society.

While the above note of Major Jenkins is passing through the press, a communication from H. H. Bell, Esq., of Agra, dated 20th October, has come to hand, extract of which, as bearing on the same subject, is here inserted for the sake of a readier reference :—

"I observe you have paid some attention to an improved churka for freeing cotton from its seed, which has been invented by Mr. Burn, and that you had applied to government for its transmission from Bombay. If it has reached you, I should be much obliged for any information as to its peculiarities. From Dr. Burn of Broach, I understand, that the native churka in use there, will clean more than six times the quantity that our imperfect churkas do, and if his brother's invention has improved on them, it is deserving of great attention, and in fact is of the highest importance in any attempt to render our Indian cotton suitable for the English market. To me, at the present moment, it is of much interest, as the Government has readily and liberally engaged in an experiment I suggested, and from which I am disposed to hope important results, if we can, in the first instance, send a cotton not absolutely unsuitable for the English manufactures. I think this is not impracticable at a remunerating price, and I am persuaded that this attained, the rest will follow."—Eds.

Perspective View of a Guzerat Churka





seeds, and there seems to be a doubt whether that even would do if driven by machinery. With our very coarse and inferior cottons, machinery is much required, but the seed and the cotton are so adhesive that nothing, but the slow manipulation with the little churka, has hitherto proved effectual.

Have you any drawing of the Baroach churka referred to by Dr. Burn? If so, its publication to a scale in the Journal might be useful: two of our churkas would not turn out above 4 or 5lbs. of clear cotton wool each in the day, which is less than half of what Dr. Burn says is the out-turn of one churka of Baroach with the same number of people.

Gowhatti: I am, &c.
6*th September*, 1846. F. Jenkins.

COMMUNICATION ACCOMPANYING TWO MODEL KODALIES, PRESENTED BY MR. EDWARD BLACK.

To James Hume, Esq., *Secretary of the Agricultural Society.*

Sir,—I beg to have the honor of making the humble offer of the accompanying model khodals to the attention of the Society, having bestowed some pains to make them as effectual and handy as possible.

The Bengalees, when they first take them up observe, that they are too heavy, but with a little persuasion they will try them, and after a short time prefer them, but the Dhangahs and Bhoonwahs take to them cherrily, and, after a little practice, they can do twice as much work with greater ease than with any in general use.

A good lusty Bhoonwah will, at one blow, send the narrow one, half the length of the blade, into any soil less hard than a metalled-road; and in moderately hard ground, it, as also the broad one, ought to go in up to the handle.

The peculiarities are these :—

1. The position of the blade, in regard to the handle, being the arc of a circle, of which the radius is about twenty-eight inches, running right through the centre of the thickness of the blade.

2. The edge being wider than any other part.
3. The internal rim round the shoulder.
4. The length of handle and weight of metal.
5. The breadth of the eye to receive the handle.
6. Its being made of wrought instead of cast iron.

The advantages derivable from each being—

1. The full effect of the force of the blow and weight of the tool falls on the edge: with much greater or less inclination, part of the power is lost, and with the greater the handle is apt to break near the blade.

2. If the edge is not the widest part, much force is wasted; the sides doing the work of the edge of the tool at a disadvantage.

3. A strengthening bar usually runs down the *middle* of the blade which is apt to throw off the earth in heaving it; the rim prevents this, and being scarp-fashioned, the clod is kept more compact.

4. A more powerful and effective blow with less exertion is obtained by having a long handle, and the weight does part of the work.

5. A broad eye gives a greater stability to the two parts, and the handle is not so likely to be broken.

6. The position of the blade can be slightly altered by the blacksmith if not quite handy to the laborers.

These, with many others, were made by common village blacksmiths, under my direction, and I never experienced any difficulty in making them understand the principle I have adopted.

The narrow khodal is adapted to breaking up hard ground or field-work, the broader to gardening, and shovelling, and so forth.

Calcutta: I have, &c.

16*th September,* 1846. EDWARD BLACK.

I have noticed, that in a gang of coolies each appropriated a khodal to himself, taking the same one every day, having first fitted the same himself, and, if necessary, had the curve adjusted by the blacksmith.

REMARKS ON THE GENERAL APPLICATION OF CHARCOAL IN HORTICULTURAL OPERATIONS.

To the Secretary of the Agri-Horticultural Society.

Sir,—Among the various substances recommended for experimentalizing in this country, I can find very few relating to charcoal; but as it has been tried with success in Europe, I see no reason for its not answering here. In a small way, I can vouch for its efficacy when used for cuttings. Lucas mentions,—(*Liebig's Chemistry, in its application to Agricultural and Physiology*, 2nd edition, page 248).

"I was gradually led to a series of experiments, the results of which may not be uninteresting; for, besides being of practical use in the cultivation of most plants, they demonstrate also several facts of importance to physiology. The first experiment which naturally suggested itself, was to mix a certain proportion of charcoal with the earth in which different plants grew, and to increase its quantity according as the advantage of the method was perceived. An addition of two-thirds charcoal for example, to vegetable mould, appeared to answer excellently for the Gesneria and Gloxinea, and also for the tropical Aroideæ with tuberous roots. The first two soon excited the attention of connoisseurs, by the great beauty of all their parts and their general appearance. They surpassed very quickly those cultivated in the common way, both in the thickness of their stems and dark color of their leaves; their blossoms were beautiful, and their vegetation lasted much longer than usual, so much so, that in the middle of November, when other plants of the same kinds were dead, these were quite fresh and partly in bloom. Aroideæ took root very rapidly, and their leaves surpassed much in size the leaves of those not so treated; the species which are reared as ornamental plants on account of the beautiful coloring of their leaves, (I mean such as the caladium, bicolor, pictum, pæcile, &c.) were particularly remarked for the liveliness of their tints; and it happened here also, that the period of their vegetation was unusually long. A cactus planted in a mixture of equal parts of charcoal and earth throve progressively, and attained double its former size in the space of a few weeks. The use of the charcoal was very advantageous with several of the bromeliaceæ and liliaceæ, with the citrus and begonia also, and even with the palmæ. The same advantage was found in the case of almost all those plants for which sand is used, in order to keep the earth porous, when charcoal was mixed with the soil instead of sand; the vegetation was always rendered stronger and more vigorous.

"At the same time that these experiments were performed with mixtures of charcoal with different soils, the charcoal was also used free from any addition, and in this case the best results were obtained. Cuts of plants from different genera took root in it well and quickly.

"Leaves, and pieces of leaves, and even pedunculi, or petioles, took root and in part budded in pure charcoal.

"Pure charcoal acts excellently as a means of curing unhealthy plants. A dorianthes excelsa, for example, which had been drooping for three years, was rendered completely healthy in a very short time by this means. An orange tree which had the very common disease in which the leaves become yellow, acquired within four weeks its healthy green color, when the upper surface of the earth was removed from the pot in which it was contained, and a ring of charcoal of an inch in thickness strewed in its place around the periphery of the pot. The same was the case with the gardenia."

And, further on, he adds :—

"It is surperfluous to remark, that in treating plants in the manner here described, they must be plentifully supplied with water, since the air having such free access penetrates and dries the roots, so that unless this precaution is taken, the failure of all such experiments is unavoidable.

"The action of charcoal consists primarily in its preserving the parts of the plants with which it is in contact, whether they be roots, branches, leaves, or pieces of leaves unchanged in their vital power for a long space of time, so that the plant obtains time to develope the organs which are necessary for its further support and propagation. There can scarcely be a doubt also that the charcoal undergoes decomposition ; for after being used five to six years it becomes a coaly earth ; and if this is the case, it must yield carbon, or carbonic oxide, abundantly to the plants growing in it, and thus afford the principal substance necessary for the nutrition of vegetables."

In regard to my own experiments, they were carried on in too general a way for me to mention here ; in fact, I have no memorandum of them. Suffice it to say, that layers, cuttings, and leaves alike seemed to root well in it, and with a much less per centage of loss than I had been previously accustomed to. It should be used in the place of sand, well powdered and kept moist.

Calcutta : Your's faithfully,

12*th September,* 1846. A MEMBER.

NOTE ACCOMPANYING A FEW SPECIMENS OF WOOD FROM THE TENASSERIM COAST—PRESENTED BY EDWARD O'RILEY, ESQ.

MY DEAR SIR,—I have the pleasure of forwarding per bearer the specimens of wood I promised some days ago.* I have forgotten the name of the one unmarked specimen, but as it is inferior to the others, and bears the marks of damage from insects, it is not of much consequence.

On my return to the Coast I will make a more complete collection and send them to you.

Calcutta: I remain, &c.
10th August, 1846. EDWARD O'RILEY.

No. 1. *Anan.*—The most useful jungle tree in the Provinces, impervious to the attack of the white ant, and grows to a diamater of three to four feet.

No. 2. *Thengan.*—(Kassia), common and very useful timber, scarcely inferior to the above, and equally serviceable, where the white ants have no access to it.

No. 3. *Thengyen.*—A very large-sized timber tree, but from being scarcer than Nos. 1 and 2, and so extremely hard, is not in such general use.

No. 4. *Katzee.*—A moderately-sized tree, growing principally on the higher lands, is useful for purposes where extreme hardness and smoothness of surface is required.

No. 5. *Yandaik.*—A bastard ebony, produced on the higher lands, where it may be had of considerable size and plentiful, used for planes and other instruments of carpenters work.

No. 6. *Peinana.*—A large timber tree, plentiful and useful for any purpose; but does not stand the attack of the white ants.

No. 7. *Padauk.*—A very useful tree, and now in demand by the Commissariat of Madras for gun carriages.

One other specimen not mentioned.

* These specimens have been placed with others, from various parts of India, in the Society's museum, and are open to the inspection of the public.—EDS.

PROGRESS OF TEA CULTURE IN KEMAON, GURHWALL, AND THE DEYRAH VALLEY. CULTIVATION OF THE HOP PLANT IN THE HIMALAYA.

Extract of a letter from DR. WM. JAMESON, *Superintendent H. C. Botanic Gardens, N. W. Provinces; dated Saharunpore, 30th October,* 1846.

"Previous to leaving Hawulbaugh I dispatched some parcels of tea seeds to you. I trust that they reached in good condition. I have some thousands for distribution, and you may intimate to the members of your Society that I shall be happy to supply them. In a letter received from you last season, you mention that some members are anxious to forward seeds to Ceylon to try them there in the hilly districts. If they still wish to have some this season let me know. Our tea plantations are thriving admirably; the land appropriated by Government has been all planted, and there are in addition about one and a half lacs of young plants, and seeds to the amount of ten (10) lacs have been sown this season. In order therefore to keep pace with the increase of the plants, I am about to recommend to Government, an increase of two hundred acres to the plantations. On my recommendation Government have divided the Chinese tea makers into three divisions, one of which is to be kept at Hawulbaugh, the second sent to Pooree, and the third to Deyrah. My object in doing this is (the tea having been proved to be of superior quality) to employ the Chinese tea makers here as teachers to the natives attached to the establishment. If Government acquiesce in my views, we shall have the tea plantations this season in Kemaon consisting of 150 acres, and in Gurhwall 100 acres, and in the Deyrah Dhoon of 100 acres. The returns of tea this season is one-third more than that of last, and in addition to black tea, we have made a series of different kinds of green tea, which, in appearance, are far superior to any thing seen in the market of Upper India. I had lately an interesting experiment performed at this manufactory. It is well known that teas are extensively adulterated; to ascertain the extent to which it is carried on, I had a good sample of tea procured from Meerut, unrolled by the Chinese

manufacturers, and by them it was shewn, that two-thirds of the so called tea consisted of other leaves!

"For some years an important and interesting experiment has been carrying on in the Deyrah Dhoon, viz.—cultivation of hops raised from hop sets and seeds received per overland route from England. For three successive seasons, the plants have flowered towards the end of the rains, a highly important fact, as it shews, that their cultivation may be attended with success, there being but little risk of injury from the rains, as they generally cease in the Dhoon in the beginning or middle of September, or about the time when this plant comes into flower. The hops therefore can be gathered, dried, and packed, during the remaining fine days of that month and in October. At Mussoorie too there is an extensive brewing establishment, where the hops can be tested; those now used there being all imported from Europe. If the above experiment is successful, there is nothing to prevent all the canteens in upper India being furnished with an excellent kind of beer at a cheap rate, which would be a great boon to many of the soldiery, and would tend to do away with, to a certain extent, the use of ardent spirits."

RECIPES FOR PREVENTING THE RAVAGES OF THE CORN WEEVIL. COMMUNICATED BY T. J. FINNIE, ESQ.

To the Secretary to the Agri-Horticultural Society of India.

My dear Sir,—From the frequent allusions I observe in your journal regarding weevil in grain, I conclude it is a desideratum to ascertain what will prevent the ravages of this destructive insect. I am glad to have it in my power to point out to you a simple and easily obtained vegetable that will preserve the grain put up in it for years. The leaves of the *Melia Azedarach*, or, as it is called in America, the pride of India, or China tree, called the *Neem* in Hindoostanee, is a sure preventive, and is universally used in the southern states of America. All that is required is to put a few of the leaves in the barn with each waggon load of corn, whether maize or wheat, and to scatter some of the leaves between each tier of sacks of grain when

loading a ship. This is pretty generally known and extensively used in some districts in the N. W. P. of India. I observed it in the district of Cawnpoor, where the people preserve their grain in large pits made in the ground, which will contain from 300 to 500 maunds. Unless the grain is put up in pits it loses its vegetating powers.

The Neem tree (Melia Azedarach) is highly valuable, and is extensively used in America for its medical properties; it is ascertained to be one of the best vermifuges in nature, its effect in dislodging worms is well known, it has ever been found a remedy against the tape worm.

Camp Ettyapooram, District of Tinnevelly: Your's faithfully,
20th May, 1846. T. J. Finnie.

P. S.—I also add an extract from an American paper. The plan appears reasonable, and I would recommend its trial.

"*Remedy for the black Weevil.*—Having never seen any remedy for the black weevil which has proved so destructive to the wheat crops after they have been housed or garnered in this part of the country, and I suppose generally through the whole of the wheat-growing countries, I would state for the benefit of those whom it may concern, that I have discovered a sure remedy, so far as my experience has gone, say for the last five or six years, which is simply this: One sack of Liverpool blown salt, thoroughly mixed with one thousand bushels of wheat, or half a bushel of salt to one hundred bushels. Since I adopted this plan, I have not seen a black weevil in my wheat, or houses where it is stowed away, although kept until it was very old; but before this, my wheat was very often so cut and spoiled, as to be rendered totally unfit for bread or market. The quantity of salt here recommended is not sufficient to injure the wheat in flavor or taste; and the remedy will be found as efficacious when applied to rice."

The Corn-Weevils.

From the numerous statements and complaints that have been transmitted to me, I am inclined to believe that no insect does more mischief to stored corn, in England at least, than these weevils, of which there are two species; but neither of them are natives of this country, although one is perfectly naturalised. Probably the best plan will be to describe and figure these two species, then to relate their economy, and finally to investigate the remedies. These weevils belong to the Order Coleoptera, the Family Curculionidæ, the Genus Calandra,* and one species is called by Linnæus—

* Schönherr, who supersedes established names, I think unnecessarily, has changed this to *Sitophilus*.

7. C. Oryzæ, the Rice-weevil. It is smooth, elliptical, and somewhat depressed; some specimens are of a pale chestnut or ochraceous color, others are the tint of pitch, with every shade between the two extremes, regulated possibly by the age of the insect; the head is semi-ovate, the base smooth, and capable of being withdrawn into the thorax; it is sparingly punctured; the eyes are not at all prominent, but black, granulated, elliptical, and vertical; the space between them has a deep V-shaped groove, with a smaller one on each side; the fore part of the head is elongated into a stout rostrum or beak, twice as long as the head, nearly cylindrical, straight, smooth, and sparingly punctured; it is a little dilated at the base, with 4 grooves or lines of punctures, especially in the males, in which sex it is the stoutest; at the tip is the mouth, which is very minute, but composed of 2 horny mandibles, serrated so as to form 4 large teeth, the maxillæ are minute terminated by an oval lobe, with a slender triarticulate palpus on the outside; the horns are as long as the rostrum, and inserted on each side of it, close to the base; they are 9-jointed, the basal joint is very long, and forms an elbow with the remainder; the 2nd is subglobose, the 3rd obovate, the 4 following are short, more or less cup-shaped, the remainder forming a stouter ovate-conic club, the basal joint being by far the largest; the thorax is twice as broad as the head, oval, but truncated at the base, with the angles rounded; it is suddenly narrowed before, at the base of the head, and the whole surface is covered with large deep punctures, leaving a smooth line down the centre, but almost uniting on the sides; the scutellum is minute and semi-ovate; the elytra are about as long as the head and thorax, not broader, oval, but truncated at the base, and sometimes narrowed a little at the middle; the dark specimens have 4 distinct orange-colored spots, 2 on the shoulders and 2 near the tips, and there are regular rows of confluent deep little pits down the back, with lines of minute bristles between the alternate rows; the wings are ample, and folded under the elytra; the under side is coarsely punctured; the 6 legs are very strong, and rather short; they are also punctured, especially the thighs, which are stout; the shanks are short, slightly compressed, with series of minute bristles down the outside, and a short curved claw at the external apex; the tarsi can be bent quite back against the shanks, and are 4-jointed; the 3rd joint is bilobed, the 4th clavate and furnished with 2 minute claws: it is only one and three-quarters line long, and scarcely two-eighths broad.

I have often in early life found these beetles amongst rice, from which grain it receives its specific name *Oryzæ*, and it no doubt was originally imported from the East Indies with that important article of food; but I have seen it infesting wheat from Ancona, sent to Mark-lane for sale in 1844, and from various granaries. Professor Royle also transmitted me specimens which were destroying East Indian wheat in the ships by which it was brought over to this country.

On cutting open the grains of the Ancona wheat, I found at the base of the kernel, in multitudes of instances, a cavity containing a very small larva, curled up, of a dirty-white color, with a ferruginous horny head. This is the young grub of the weevil, and I have no doubt the egg is deposited by the female in this end of the grain, but I have never succeeded in obtaining the eggs or rearing the larvæ. I could not help remarking, that however sound the grains might appear outside in this sample, there were scarcely any that had not been perforated; and I could not find one in twenty that did not contain some of the beetles or grubs. The pupæ that I found *in situ* were all dead, and consequently not such perfect objects as I wished to delineate: they are, however, like most weevil pupæ, of a yellowish-white color, and soft, with the rostrum, antennæ, legs, and elytra visible through the skin.

It is evident they are preyed upon by a parasitic hymenopterous insect, for in one of the grains I detected an apterous blackish-green specimen with rufous legs, but it was too much mutilated to draw from. I am pretty certain it is the same species, or closely allied to one, named *Meraporus graminicola*,* which we often find in this country in July.

The other species of corn-weevil alluded to received the name of *Curculio granarius* from Linnæus. It belongs to the same genus as the preceding beetle, and is now called—

8. Calandra granaria. The granary-weevil is a little longer, and more smooth and shining than *C. Oryzæ*; it is somewhat depressed, and varies in color from a deep pitch to a dark chestnut tint; the head is semiglobose, produced anteriorly into a longish, smooth, cylindrical proboscis, which is shortest and stoutest in the male: it is slightly curved, and sparingly punctured, with 2 lines of punctures extending almost from the base of the head to the apex, forming two deep channels before the eyes, where the rostrum is dilated; on either side of these are one or two lines of punctures: the eyes are black, vertical, ovate, finely granulated, and depressed; the mouth, including the little strong jaws, maxillæ, and palpi, is placed at the extremity of the rostrum: the antennæ, which are as long as the rostrum, are inserted on the sides close to the base, they are nine-jointed; the basal joint is long, stout, and clavate; it forms an angle with the remainder, the second being subglobose, the third obovate, the four following more or less cup-shaped, the seventh being the largest, the residue forming an oval, conical, little shining club, pubescent at the tip: thorax twice as broad as the head, oval, a little truncated and suddenly narrowed before, with a transverse impression; greatly truncated at the base, which is bisinuated: the surface is coarsely, not closely, punctured with oval points; scutellum minute and oval; elytra exactly equal to the thorax and head, occasionally a trifle broader near the

* Vide Curtis's Guide, Gen. 630 *f*.

base, being ovato-truncate, and not covering the apex of the abdomen; there are 9 deep punctured channels down each, producing short pale bristles, and the 2 raised furrows on each side the suture have a line of long punctures; wings, none, or rudiments only: the under side is covered with exceedingly large punctures: the 6 legs are punctured, strong, and stout, especially the first and last pairs; the thighs are stout; the shanks are shorter and straight, the anterior are crenulated inside, and they all have a hook or claw at their extremities; the tarsi are reflexed and four-jointed, spongy beneath, basal joint subclavate, second ovate, third broader, slightly bilobed, fourth clavate, and furnished with two minute claws: length nearly 2 lines, breadth two-thirds.

It is remarkable that whilst *C. Oryzæ* has a pair of serviceable wings, *C. Granaria* is destitute of the organs of flight, at least in this country.* I regret that I have no experience regarding the transformation of this species, for all my attempts to rear it have been unsuccessful. In June, 1844, I carefully examined some barley in a box, which I had procured the previous autumn; numbers of the weevils had hatched, and many were lying dead, but I could find neither eggs, larvæ, nor pupæ. Leuwenhock and Olivier, however, will supply this deficiency; the former of these authors made many observations, which were published as long back as the year 1687, and the latter in the 'Encyclopédie Méthodique.' It has been ascertained that after the weevils had paired, the female made a hole in the grain of wheat with her rostrum and deposited an egg in it, from whence hatched a little maggot, which during its growth ate out the entire contents, and then changed to a pupa in the empty husk, and eventually the perfect beetle ate its way out. The maggot is nearly a line long, very white, soft, and elongated; the body is composed of projecting and rounded segments, and is furnished with a large, horny, round, yellow head, with teeth or jaws to nibble the substance of the grain. Only one maggot is found in each grain, as it is no more than is necessary to support it whilst it is in that state.† The pupa is a clear-white, and transparent, so that one can distinguish through the envelope the rostrum, antennæ, and the other members of the insect. In this state, of course it takes no nourishment, but lies dormant, and only shows symptoms of life by moving its abdomen when it is disturbed. Eight or ten days after this metamorphosis the weevil bursts the filmy skin in which it is swathed, and pierces the epidermis of the grain to form an aperture and leave its prison. It is the maggots which make the greatest havoc amongst the corn, yet it is evident that the weevils also feed upon it, as they are sometimes found, of a dark color, enclosed in the grains.

It is well known that a certain degree of heat is necessary to invigorate these weevils and induce them to copulate. If the temperature be under 8°

* It is very probable that in warm latitudes these organs may be fully developed.

† Encyclopédie Méthodique, vol. v. p. 488.

or 9° (50° or 52° Fahr.) the sexes have not sufficient energy to search for one another; they live in a state of repose and even of torpor if it be cold, and are then incapable of mischief. On the return of spring, especially in countries where that season is sufficiently favorable to raise the temperature to 10° (54° Fahr.), the sexes pair; this happens about April in the south of France, and they go on propagating until the end of August: so that the destruction of grain is much more considerable in the southern than in the northern provinces. The warmer it is the oftener they pair, consequently the female lays her eggs every month when the heat is sufficiently great, but as soon as the mornings begin to be cold she ceases to lay; and such is the vast multiplication of this insect sometimes in the granaries and magazines of France, that of a heap of corn, nothing but the husks is left, and all kinds of grain are acceptable to the granary-weevil.

From the moment of pairing until the time when the weevil is hatched occupies about 40 or 45 days, from which it is evident that there are many generations in a year, which, as I have shewn, multiply more rapidly in a hot country. From a very curious table, established upon the multiplication of the weevils, by adding together the number of each generation, the result obtained is a sum total of 6045 individuals proceeding from one pair only of weevils during a summer, namely, during five months, dated from the 15th of April to the 15th of September, when the thermometer is above 15° (nearly 66° Fahr.), and it never descends much lower in the southern provinces of France. As Olivier says, "One cannot be any longer astonished that enormous heaps of corn are sometimes so speedily devoured." As soon as the female weevil has been impregnated, she plunges deep into a heap of corn to lay and conceal her eggs immediately under the skin of the grains; she makes a puncture where it is slightly raised in this part, and forms a little elevation which is scarcely perceptible. These holes are not perpendicular to the surface of the grains, but oblique, or even parallel, and stopped with a kind of gluten the color of the corn. The female never lays more than one egg in each grain, which is not long in hatching, and when lodged in the grain, is perfectly secure from changes in the atmosphere, because the excrement that it makes seems to close the opening by which it entered, and even when the corn is removed it is not incommoded by any shaking it may undergo.

It will be observed that the weevils are not found on the surface, but some inches deep in the corn-heaps; it is there that they live, very often couple, and that the females lay their eggs. Moreover, on looking at a heap of corn, one cannot detect the operations of these insects in the grains where they are lodged; they have the same form, the same appearance, they seem to be as large and as firm as these which are not attacked: it is only by the weight that they can be detected, and on throwing a handful from a heap into water, the diseased grains will float. So long as the weather

remains hot the weevils do not quit the corn-heaps they have invaded, unless they are obliged to abandon them by stirring the corn with shovels or passing it through a sieve. When the mornings begin to be cool, all the weevils, young and old, abandon the corn-heaps, which are no longer a retreat sufficiently warm for them; they retire into the crevices of the walls, into the cracks in wood and planks; sometimes one even finds them concealed behind the hangings, indeed wherever they can find a safe abode that secures them from the cold, which makes them desert the granaries.

It is, however, wrong to suppose that the weevils remain in a torpid state during the whole of winter, to regain, on the return of spring, the corn-heaps which they have abandoned, and to commence laying eggs there. A general and constant rule amongst insects is, that those which have paired die soon afterwards, the males almost immediately, the females as soon as they have performed their office of laying the eggs, and that they pass the winter in the egg or larva state. It is undoubtedly seldom that those which have not fulfilled the destiny of nature can brave the rigor of the season, and do not perish before the ensuing spring. The weevils seem to love darkness and to remain undisturbed, since, when they are exposed to the daylight they scamper off to conceal themselves. Such is Olivier's account.

There is one thing to be borne in mind regarding the corn-weevils, namely, that in this country, at least, they are never found in corn-fields, the eggs are consequently not laid until after the wheat or barley has been threshed out, and the *C. Oryzæ* requires a much higher temperature to invigorate it than the *C. granaria* does; it is therefore only under very favorable circumstances, such as an unusually hot summer and mild winter, or in granaries naturally warm from local circumstances, or in the close holds of ships, that this species can cause any alarm in our temperate climate. It is in the East and West Indies far otherwise, and even in the south of Europe, as we have seen by the wheat from Ancona. Mr. Sells, who had resided in some of the West India Islands, stated before the Entomological Society that "*C. Oryzæ* was exceedingly abundant in the stores there, destroying great quantities of Indian corn and rice, and, to prevent its attacks, it was necessary to expose the grain to the sun, and to winnow it frequently."*

It is the *C. granaria* which does incredible mischief to our stored corn, as may be collected from the remarks already made, and barley and malt suffer the most from their inroads. I put these beetles into a box with barley, maize, beans, peas, and wheat one autumn, and in the spring I found the barley was all eaten out, and a few grains of the maize were completely excavated; but the wheat, peas, and beans were untouched. On the other hand, in December, 1843, I received some *wheat* and black oats from Lynn, in Norfolk, in which the weevils abounded and had caused a great waste. The

* Transactions of the Entom. Soc., vol. i, p. lxxviii.

season suited to the propagation of the corn-weevils appears to be uninterrupted, for I have observed them in extensive flour-mills in Norfolk in the spring; in June and July they were abundant in the sweepings of a malthouse in Norwich; in September and the three following months in granaries, and during the winter they attacked and ate up some pearl-barley; and at certain congenial periods the beetles may be seen in multitudes, even on the outside of granaries and malthouses in London.

So important is this subject, that a variety of remedies have been successively proposed for many years, which I shall now consider; and, although some of them may appear trifling, they will not only show how far advanced we are above our ancestors in such knowledge, but they may chance to elicit better modes of application, and even to suggest new ideas. We first hear of fumigation, with herbs having a strong and disagreeable odour; but this seems to have been useless, as the weevils, by burying themselves amongst the grain, are by no means incommoded, whilst the corn has suffered from fetid and disgusting scents which have been communicated to the grain. It is even asserted that the scent of spirits of turpentine appeared to cause the weevils no inconvenience; but I think if it had been persevered in for several consecutive days, excluding at the same time the ingress of air, that it must have destroyed them. The fumes of sulphur are said to be equally inefficient; and all these fumigations are still less adapted to destroy the larvæ, as the smoke cannot penetrate amongst the grain.

Olivier* also says, "Some have imagined, by putting the corn in pannelled cellars, or by sifting it in winter, the corn would be secured from the weevils; but this is a great mistake, for, independent of the difficulty of preventing its germinating and rotting, the weevils would be undisturbed, and more sure to commit their ravages. The sifting is likewise useless in winter, as the weevils have then left the corn-heaps; the eggs are also so well glued to the grain that it is impossible to separate them by sifting or stirring with the shovel. Experiments have proved that a sudden heat of 19° (about 75° Fahr.) is sufficient to destroy the weevils† without burning them; but this would not suffocate the insects when they are buried in a heap of corn. It has been observed that a heat of 60° or 70° (167° or 190° Fahr.) is necessary to kill the weevils in the stove; but this excessive heat, which has the advantage of destroying the eggs and larvæ inclosed in the grain, is capable of drying the corn too much, even of burning it, and yet does not preserve it from the insects secreted in the granary, which will come out and attack it if there be no other for them."

* These suggestions are translated from the Ency. Méth., vol. v. p. 444.

† The discrepancies and attendant doubts regarding these subjects are fit inquiries to be made by some talented chemist and entomologist; but as the time such experiments and investigations require cannot be expected to be made by scientific men without remuneration, it is to be hoped that some plan may be adopted by the Government in this enlightened age to settle such important questions which would be doing an essential service to the country.

In a short communication to the Entomological Transactions, some valuable data upon this point are furnished by Mr. Mills, who was in Madeira from January to August, 1835. In that island he thinks the eggs are first deposited whilst the maize is in flower, and he ascertained that he could hatch the eggs at 110° of Fahr., whilst from 130° to 140° of heat killed them. He adds, "A gentleman of the name of Wilkinson in Madeira, has now established a heated room with hot-water pipes, in which he receives as many as 800 bags of wheat at a time; these become heated through at about 135°, and the wheat, when resifted, is perfectly cleansed from these noxious insects, and makes quite as good bread as before. I also tried some of it in the ground that had been subjected to this heat, and it came up."*

Olivier then recommends a ventilator to introduce cold air which has already been discussed in the remedies proposed for "the Grain-moth," as well as the forming of little heaps of corn in the spring to act as decoys. He says that when the weevils have taken possession of them, boiling-water should be poured on the heap, at the same time turning it over with a shovel, in order that the heat may penetrate everywhere: it ought afterwards to be spread to dry, and then sifted to free it from the dead weevils. This should be done at the commencement of spring, before the eggs are deposited, by which precaution a fresh generation is stopped.† The introduction of cold air is, I expect, to be recommended for various reasons: at Lynn in Norfolk I have heard it is the practice and the readiest way of getting rid of the corn-weevils, to expose an empty granary to two or three nights' frost by setting all the windows open.

In a French work we are told ‡ it is an excellent plan "to lay fleeces of wool, which have not been scoured, on the grain; the oily matter attracts the insects amongst the wool, where they soon die, from what cause is not exactly known. M. B. C. Payrandeau related to the Philomatic Society of Paris, that his father had made the discovery in 1811, and had since practised it on a large scale."

After all that has been said, I shall only revert to the necessity of keeping storehouses clean and aired, and I have the authority of gentlemen of great experience in London to state, that by stirring or turning over the malt frequently, and taking every opportunity of whitewashing the walls whenever the granaries are at all empty, they experience no loss from the insects I have just recorded.—[From a paper entitled "Observation on the various insects affecting the corn crops," by John Curtis, F. L. S. in the last published volume, vol. vii., part 1, of the Journal of the Royal Agricultural Society of England.]

* Observations upon the Corn-weevils, by William Mills, Esq., F. L. S. Trans. Ent. Soc. vol. i. p. 241.

† Ency. Méthod. vol. v. p. 444.

‡ Bulletin des Sciences Agric., July 1826, p. 24.

CAPABILITIES OF CHOTA NAGPORE FOR THE CULTIVATION OF COFFEE.

Extract of a letter from Lt. Col. J. R. Ouseley, *A. G. G., S. W. Frontier, dated Burkaghur, 24th October,* 1846.

"I have much pleasure in sending answers to the queries of a Ceylon planter relative to coffee; and as it is desirable as much information should be given as possible, I send a copy of my last coffee report and register of rain fallen during the year: we have showers all the year round. The coffee grown here, used by me, is pronounced to be finer than any ever seen, and of better flavor."

1. How far is Chota Nagpore from Calcutta, and in what direction by compass?

About 209 miles from Calcutta: Chota Nagpore being nearly West: a *little* North of W.

2. What is the extent of land under coffee cultivation in that district at present?

The Government experimental plantation is 11 acres, 2 roods. My own about 10 acres; the Government plantation will be extended about 42 acres this year.

3. What is the description of soil in which the coffee is planted?

Light reddish soil, but rich and productive.

4. Was this a virgin soil, and was it open land or covered with forest?

The soil was under cultivation when taken in for coffee, it was under oil seed and light Khurreef or paddy, *upland.*

5. What is the greatest elevation at which similar land, or land covered with large forest trees and good soil, can be obtained in the vicinity of the present plantations?

From 2 to 3,000 feet above the sea, table land: similar lands for a hundred miles East and West, and 50 North and South, all open, clear, and fit for coffee.

6. Is labor plentiful, and at what rate procurable?

The best earth-workers in India, Dhangurs, are the people of the country, and to be had for 1 anna a day or 2 Rs. a month; are to be had in any numbers.

7. What is the language spoken by the inhabitants? Bengalee? Hindee? Oordoo? or what?

Cole and Hindee, but all speak the latter well enough to be understood.

8. What is the nearest shipping port to Burkaghur, and what sort of road between?

Calcutta. The road, earliest part, being a *made* one, as far as Burdwan: my supplies come on hackeries from Calcutta in 20 days.

9. What is the expence of transport from Burkaghur to that port per hackery load or package?

Hackeries are to be had for 16 rupees the trip.

10. Is the means of transport abundant and easily to be obtained?

Abundant, and, on a greater demand, hundreds of hackeries would be supplied.

11. Are the seasons in Chota Nagpore similar to what you have in lower Bengal, or are they wetter or dryer? or in what other respects do they differ?

No: very different from Bengal, being dryer and cooler; the average height of the thermometer being about 75°, and showers all through the year.

12. Has the Pluviameter been noted at Burkaghur? if so, how many inches of rain per annum does it exhibit?

The Pluviameter gives this year an average of 10 inches a month, for June, July, August and September.

13. What is the maximum and minimum range of the thermometer throughout the year, and the mean daily temperature of the hottest month?

In May, the hottest month, the mean would be about 83°. It seldom freezes in the cold weather, or from December to February.

14. Is the climate reckoned a healthy one for Europeans? and can they bear exposure to the sun at midday with impunity? (Here we are out all day long.)

The climate is very healthy for Europeans: we do not expose ourselves in the hot months, not having occasion. Natives from other parts of India dislike the climate, being too cold for them.

15. Are the necessaries of life abundant?

At present rice sells from 80 to 90 seers for a rupee. Boot gram for 40 seers, kalye or oorid 70 or 80 seers, sheep 1 rupee each, lambs 8 annas, fowls 30 to 50 for a rupee, cows 3 to 5 rupees, bullocks 7 to 10 rupees.

16. Are the inhabitants a steady race, willing to work for pay? or effeminate and lazy, like the Bengallees?

The Natives are stout able men, willing to work, and very unlike Bengallees.

17. Is limestone or other material (say kunkar or shells) for lime-making found in the district? Is brick, clay, ditto?

Lime kunkar, or limestone (both kinds) abundant.

18. Is timber of sufficient scantling for houses, stores, &c. procurable?

The finest sal trees for timbers of 30 feet long by 18 inches.

19. Are artificers procurable in the district? viz: sawyers, carpenters and masons, and at what rates of pay per month?

All sorts of workmen are procurable: a good mason 8 to 5 rupees: a carpenter 10 to 5 rupees: a blacksmith 10 to 5 rupees.

20. Are implements procurable, such as pit and cross saws, felling axes, quintanees, pickaxes, crowbars, &c.

We get all implements such as saws, axes, &c. from Calcutta. Hoes, &c. are made in the district; iron being abundant and of excellent description.

21. Is the high land in the vicinity of Burkaghur, intersected by streams of water at all seasons of the year?

There are a vast number of little streams in all directions, some dry up, and others flow all the year.

22. Upon what terms could a grant of land (say from 500 to 1000 acres) be obtained in this district? I mean forest or other virgin soil adapted for cultivation of coffee, and at a suitable elevation?

For 1,000 acres of *forest* lands, 10 or 12 miles from Chota Nagpore, I think 25 or 30 Rupees a year would be demanded; if open and nearer, 100 or 200 Rupees, according to the quantity of low land included. The whole country is from 2 to 3,000 feet in height above the sea.

23. What degree of encouragement and support would an experienced planter settling himself in the district with a view to the

cultivation of coffee on a large scale, receive from the local authorities and other parties interested?

From myself, as the head of the office, I could insure every encouragement and assistance, as also from my subordinates in charge of the districts. Nothing would give me greater pleasure than forwarding so desirable an enterprise as that proposed by the Ceylon planter. It is not like indigo, when forced labor is so often resorted to, and when native agents are guilty, frequently, of such gross abuses, breaches of contract, and ultimately of the peace. This is a standing crop, and could only be superintended by the speculator himself.

To C. BEADON, ESQ., *Under-Secretary to the Government of Bengal.*

SIR,—I have the honor to forward for the information of the Hon'ble the Deputy Governor of Bengal, a report on the state of the Government Experimental Coffee Garden, established as by order of Government, dated 10th July, 1843, No. 743.

2. The extent of the present garden is eleven acres, two roods, and contains in all 3,728 plants, of which 321 are this year producing fruit; 562 will next year, and the others are of smaller size. White ants are the only enemies to the plants. Many plants are destroyed yearly by them.

3. The seed from which the plants are now renewed, grow in my private garden, and are from Mocha stock, on which very favorable reports have lately been given on small samples of coffee sent to England, copies of these I have the honor to send.—[See page 139.]

4. On the establishment of the plantation, the soil was duly reported on, and it appears to be peculiarly well adapted for coffee cultivation, but as the rainy season affects the flavor of the coffee, if over-abundant, I beg to send a register I have kept of the rain that has fallen this season, from the 1st June to the 9th October. This moderate and gentle fall of rain is just what I understand induces the most luxuriant crops, and imparts a delicate flavor to the coffee. We have rain in showers at times all the year.

5. With the permission of the Government, I would, without adding more than the annual rent to the expense, extend the plantation along the same ridge of land to the extent of about forty-two

acres, so as to establish a certain and unfailing supply of plants for the people of the country. I shall be able to supply plants sufficient from my own stock in the first instance.

The present expense is 2 gardeners, per annum Rs.	72	0	0
Wood, bamboos, grass, ropes for wells, &c. &c.. ..	20	0	0
Annual rent of $10\frac{1}{2}$ acres, ...	12	0	0
	104	0	0
To this would be added for the extra land above mentioned, about	30	0	0
Total Rupees ..	134	0	0

I have, &c.
(Signed) J. R. Ouseley,
Governor General's Agent and Commr.

Governor General Agent's Office, Chota Nagpore :
The 18th October, 1846.

Register kept at Chota Nagpore of Rain that fell from the 1st June to the 10th October 1846. Guages Nos. 1 and 2 on the top of the House, No. 3 on the Ground.*

	June.		July.			August.			September.			October.		
	No. 1.	No. 2.	No. 1.	No. 2.	No. 3.	No. 1.	No. 2.	No. 3.	No. 1.	No. 2.	No. 3.	No. 1.	No. 2.	No. 3.
Total inches	$9\frac{3}{10}$	$9\frac{5}{10}$	$7\frac{2}{10}$	$7\frac{3}{10}$	$7\frac{1}{10}$	$10\frac{9}{10}$	$11\frac{0}{10}$	$10\frac{5}{10}$	$9\frac{7}{10}$	$9\frac{7}{10}$	$9\frac{3}{10}$	$1\frac{4}{10}$	$1\frac{5}{10}$	$1\frac{4}{10}$

REPORT ON WOOL, THE PRODUCE OF THE FIRST CROSS BETWEEN CAPE MERINO, AND JUSSULMERE SHEEP.

Extract of a letter from H. Hamilton Bell, Esq., *dated Agra, 20th October,* 1846.

"I send you by this day's dâk banghy, as likely to be of some interest to your Society, a small parcel of wool, from the first cross of the Cape Merino, and Jessulmere sheep, and I think you will

* We think it unnecessary to give the daily detail as the total of each month appears sufficient.—Eds.

consider it not unworthy attention and promising, as a really fine wool on the third or fourth cross. The Merino rams suffer greatly from the extreme heat, and require a good deal of attention; but they seem healthy. I am, however, a little doubtful of any result from my experiment. Little pasture land is now left in these zillahs, and after the rains have ceased for a month or two, it affords little sustenance. I have found a moderate feed of grain indispensable, and I scarcely anticipate a return from the wool that would repay the expense. Some of the ravines on the banks of the Jumna have a good deal of grazing land fit for sheep, and one of my villages is situated amongst them; but it is out of the way, and I cannot trust my flock at a distance under native care, at all events, till the breed has been brought as close to the Merino as seems necessary."

[The above muster was referred to a party who has lately arrived from the woollen manufacturing district of England, and whose practical knowledge of the article is great, and he reports it "a very clean, useful article to the manufacturer, and, in the state of the sample, every way equal to it in quality and cleanliness: would be worth about 14 pence per lb. in the English market some two or three months ago." It is, however, worthy of remark, that to judge properly of the value of this wool, it would be necessary to have a *whole fleece* taken off and folded up unbroken, as the quality will vary much in different parts of the fleece.—Eds.]

ON THE SOURCE OF THE CARBON AND NITROGEN IN PLANTS, AS DERIVED FROM THE SOIL.

By P. F. H. Fromberg, *First Assistant in the Laboratory of the Agricultural Chemistry Association of Scotland.*

Having lately seen the results and opinions on the action of humus and the origin of ammonia in the soil, which have been obtained and stated by my friend and teacher, the celebrated chemist and physiologist, Professor Mulder of Utrecht, called in question in a recent periodical, *(the Agricultural Magazine,* April 1845), and supposing that some to whom Mulder's name and book *(the Chemistry of Vegetable and Animal Physiology)* are not so well known as they ought to be, may be persuaded by these remarks that Mulder is not worthy of entire credit, I have thought it my duty not only as Mulder's pupil and translator, but also for the sake of true science, to make a

few observations, with the view of fairly representing his experiments, as contained in his memoir, entitled "On the Condensation of the Nitrogen of the Atmosphere in the Soil, and on the Nutritive Properties of the Organic Constituents of the Soil for Plants."

The opinions of Mulder which have been impugned are,

1*st*, That the several organic constituents of the soil, namely, the humic, ulmic, geic, crenic and apocrenic acids, after being combined with ammonia, are, as such, taken up by the roots and assimilated by plants, on the ground that the compounds which these acids form with ammonia are so very readily soluble in water, and because these several acids possess polybasic properties, by which they are enabled to form combinations with potash or soda, ammonia, lime, magnesia, and oxide of iron, in which several of these bases are present at one and the same time.

2*nd*, That ammonia is formed in the soil by the combination of the nitrogen of the atmosphere with hydrogen in the nascent state, as liberated during the decay of vegetable and animal substances in the soil.

Those opinions Mulder has, I think, very fairly, derived from a number of experiments of great value and originality.

The objections stated in the periodical above alluded to are, that these experiments were partly unfair and in part were wrongly interpreted, and that Mulder's opinion in regard to humus is incorrect, inasmuch as the excretions from diseased elms consist of humus, it being, according to Liebig, absurd to suppose that a diseased plant could form the substance to which its health and vigor are to be ascribed; and, further, because charcoal has been discovered to increase the growth and heighten the color of plants. Several other arguments are also adduced, which, however, like those advanced for Liebig's theory concerning the origin of ammonia in the soil, I shall here pass unnoticed, as being almost entirely speculative. The only one which deserves more attention, and which I shall afterwards have occasion to refer to, is that which refers to the inert or indifferent properties of nitrogen, from which a direct union with hydrogen would appear to be impossible.

It will, therefore, be my first object to shew that Mulder's experiments are neither unfair nor their results incorrectly interpreted.

I. Of his experiments upon humic acid I may be permitted here to give a full account, which has not been done in any other than the original language. I may mention, beforehand, that I had an opportunity of personally inspecting the progress of the experiments to which I shall refer.

Mulder selected an apartment perfectly free from exhalations. In it he placed, close to one another, several glass vessels of equal size. These vessels were divided into sets, (each set being composed of five vessels,) and contained different substances, as mentioned below. In each set he placed the seeds of five different plants, namely, *a*, brown beans; *b*, white beans; *c*, garden peas; *d*, barley; *e*, oats. They were kept moist with distilled

water. The experiments continued from the 16th of May till the 16th of June 1843, and the results were as follows :—

COMPONENTS.	RESULTS.
SET 1. Containing coarse sand, thoroughly washed with distilled water.	Very imperfect—the plants were scarcely four inches long, and almost all withered.
,, 2. Coarse sand, mixed with one per cent. of wood ashes.	*a* Did not grow—*b* very weakly—*c* tolerably well—*d* very imperfectly—*e* a little better.
,, 3. Coarse sand, ashes, and ulmic acid from sugar.	*a* Imperfectly—*b* tolerably well—*c* very well —*d* not at all—*e* very well.
,, 4. Coarse sand, ashes, and apocrenate of ammonia.	*a*, *b*, *c*, and *d*, did not grow—*e* very weakly.
,, 5. Sand, ashes, and humate of ammonia from garden mould.	None of the seeds grew ?
,, 6. Sand, ashes, and humic acid from garden mould.	*a* Very luxuriantly—*b* not at all—*c* imperfectly—*d* not at all—*e* tolerably well.
,, 7. Sand, ashes, and aqueous extract of humus, *i. e.* mould boiled out with water, and the solution concentrated by evaporation.	Only *d* grew up, though weakly.
8. Sand, ashes, and ulmate of ammonia from sugar.	*a*, *b*, *c* and *e* most beautifully—*d* imperfectly.
9. Sand, ashes, and humate of ammonia from peat.	*a*, *b*, *c* and *e* equally beautiful—*d* not at all.
,, 10. A quantity of common soil.	Exactly the same results as in No. 9.
,, 11. A mixture of charcoal, first heated to redness, and then cooled in a closed vessel, with wood ashes.	All succeeded, but were far inferior to the plants grown in the three last experiments.

From these accurately conducted experiments Mulder draws the following conclusions :—

1. That rain-water and atmospheric air are insufficient to support the life of plants.

2. That rain-water, wood-ashes, and air, are equally insufficient.

3. That the aqueous extract of humus contains too small a proportion of organic matter, to afford to plants all that they require.

4. That ulmic acid from sugar, though devoid of nitrogen, is really advantageous to the growth of plants.

5. That humic acid from garden mould is very useful in vegetation.

6. That humate of ammonia, from peat, is advantageous to the growth of plants.

7. That charcoal and ashes are inferior to arable soil, or to the substances mentioned in 5 and 6.

I may remark, that the same substances often acted differently upon different plants, as might have been anticipated ; and this is possibly one of the reasons why different experimenters have obtained different results and have come to different conclusions.

But what I would now more especially allude to is the assertion that, in the experiments (8 and 9) in which humate and ulmate of ammonia were used, the plants grew so well, *on account of the ammonia*, and that the experiments conducted with sand and ashes were not fair, inasmuch as this was not a fair condition for plants to grow in.

Now, I would ask, if the plants grew there on account of the ammonia, why Nos. 4 and 5 failed, and why No. 10, though the materials contained very little ammonia, succeeded very well ? I will not advert to the imperfect suc-

cess of No. 11, which, according to Liebig's theory, ought to have succeeded best; but, confining ourselves to Nos. 4, 5, and 10, I would ask if a rule inadequate to explain every case ought to be considered as certain, or rather if a theory which explains certain results, but leaves other results, obtained under analogous circumstances, unexplained, is deserving of the support of the unprejudiced? It may perhaps be said that the apocrenic acid and the humic acid from mould differed so much from ulmic acid obtained from sugar and humic acid from peat, that they entirely prevented the action of the ammonia with which they were combined. But this objection possesses very little weight, and, as I know of no other which could be advanced, I shall proceed with the consideration of another and more important objection, namely, the alleged unfair condition in which plants are placed when grown in sand, ashes, and water.

As to this, I would ask—if plants require nothing but carbonic acid, water, and ammonia, (all of which they ought to have obtained from the air,) and a few inorganic compounds, which, as is proved by the experiments of Wiegmann and Polstorff, are gradually dissolved from the sand, through the protracted action of the atmosphere, but which were in this case previously supplied by the wood-ashes—if, I say, plants require nothing else, why was the sand, &c., an unfair condition for the plants to grow in? All that the roots require—moisture, darkness, a certain degree of heat, and the access of atmospheric air—was here present, and, nevertheless, this is called an *unfair condition.* I am unwilling to call this assertion a pretext for avoiding explanation of discussion on account of a conviction of the weakness of the principles advocated.

It is easy enough to maintain a theory, if we are allowed to bring it into operation in the manner most suitable to the theory itself, but both impartiality and respect for the opposite theory induced Mulder, to prevent, as much as possible, the plants from obtaining their organic food from any other source than the atmosphere; hence, if this experiment had succeeded it would have been a most brilliant proof of the truth of Liebig's theory; but, had the plants been placed in a so-called fair condition, by which, I presume, is meant certain admixtures of organic matter, the experiment, however successful, could not have been considered by an impartial judge as any proof whatever of the correctness of his principles.

I shall for a moment advert to what Liebig calls absurd—the formation by a diseased plant of a substance to which its health and vigour are to be ascribed. I would beg to place the question in a somewhat different light. Is it not very natural and obvious that a product of a plant, when no longer under the influence of vital action, and hence in a state of putrefaction, should first be converted into those substances which, in the growth of plants, constitute the transition to a perfect organization? If the question regarded some special substance, gum or resin for instance, excreted in consequence of a peculiar direction of vital action in healthy plants, it would be absurd to

assume that these excretions, *as such*, were proper food for the plant ; but humus is a *general* product into which all putrefying organic bodies are converted, and can, therefore, by no means be termed an *excretion.* The product of the diseased elm in question was evidently no longer under any influence of the vital action when it was converted into humus, and hence a difference should be made between the immediate and peculiar product of a certain disease, and the secondary state of humus into which this product is subsequently changed.

The well-known fertilizing action of charcoal requires, indeed, no other explanation than its characteristic property of condensing gases, through which, a large quantity of atmospheric air being condensed within a small space, and in a condition as yet unknown, a far larger proportion of oxygen and nitrogen is afforded to the putrefying matter, as I shall afterwards have an opportunity of explaining: hence, therefore, it has no direct relation to the production of carbon in plants.

I think it proper to advert here to some opinions of Professor Johnston upon this point,* which tend to shew that this distinguished writer agrees completely with Mulder's views. He says that experiments have proved that the bulk of oxygen exhaled by the leaves is generally smaller than that of the carbonic acid absorbed by them—a fact which has induced Berzelius and Persoz to assume that, not the carbon of this carbonic acid, but carbon in some lower state of oxidation (according to Parsoz, carbonic oxide) is retained by the plant. Further, that, as far as is yet known, neither the stem nor the roots have the power of decomposing carbonic acid or secreting oxygen. If, therefore, plants take up carbonic acid from the soil, it must either be in small quantity, or the bulk of oxygen separated by the leaves during the day must be considerably greater than that of the carbonic acid taken up by them, or else the stem and the roots must have the power of secreting oxygen also. The two latter circumstances appear to be in the opposition to experience, and hence the former is also untenable.

The same writer further remarks, that as the coloring matter of *Phytolaca decandra* and of *Rubia tinctorum* are absorbed by plants—that of the former penetrating, as shewn by Biot, in the case of a white hyacinth, as far as the flower—this proves the *possibility* of organic substances entering through the roots into the circulation of the plant. Davy has also shewn that plants of mint grow vigorously in solutions of sugar, gum, jelly, &c., even when the soil in which grass grew was watered with those solutions, the plants throve bettor than when common water was applied.

Though I admit, therefore, that the quantity of carbon which the plant derives from the assimilation of soluble organic substances in the soil *varies* with circumstances, I consider it most absurd to suppose that, when the water in tho soil is impregnated both with soluble organic and inorganic

* "Lectures on the application of Chemistry and Geology to Agriculture," pp. 88-203.

substances, the roots should have the power to *select* the latter and to *refuse* the former.

II. Now, proceeding to the very interesting experiments on ammonia, I shall again commence by giving a simple account of the experiments themselves, and then go on to weigh the importance of the objections which have been adduced.

Before commencing this, however, I must first prove the *possibility* of the nitrogen of the air being converted into ammonia, as well as into nitric acid. I am well aware that the inactivity or indifference of nitrogen has been advanced as a proof to the contrary; but, in reply to this, I would ask whence has ammonia been derived originally? Was ammonia present, ready formed, from the creation of the world, and is the quantity in the world and its atmosphere exactly as great now as it was then? If the absurdity of this be admitted, why may not the same causes, by which ammonia was first formed from nitrogen and hydrogen, still produce the same effect? It is indeed such a theory as ascribes the origin of ammonia in the soil to nothing else than to the ammonia washed down from the air by the rains, that is obliged to assume an atmosphere, filled with little germs invisible to every one but to the supporters of the theory themselves, and to consider *peculiar* germs indispensable for the production of mould plants.

But I must not anticipate. I shall first prove the *possibility* stated above, and the *non-indifference* of nitrogen, by the following facts:—

1°. Cavendish obtained nitric acid by passing electric sparks through moist atmospheric air.

2°. The same acid is produced when a mixture of nitrogen and hydrogen is burned in the air.

3°. Coke, when heated to redness with potash, in a current of air, produces cyanuret of potassium.

4°. When reddened litmus paper is hung up in a bottle filled with pure atmospheric air, having pure iron filings moistened with pure water laid at the bottom, the red litmus is turned blue by the action of ammonia formed from the nitrogen in the air and the hydrogen of the decomposed water, the oxygen of which has combined with the iron. When either the iron filings or the water is absent, no change of color is produced.

To this last fact it is objected that the blue color may be caused by deoxidation of the red. But what can be objected to the following considerations?

It is not proved that the blue coloring matter of litmus contains less oxygen than the red. Therefore there is no reason why by this action the blue color should be produced in preference; but, even granting that deoxidation is the cause of this change of color, then the same explanation may be applicable to the action of alkalis. If this is true, the action of alkalis and that in the above experiment coincide, and we are not a step farther forward by assuming the foregoing explanation.

To these facts I may add a few more, as recorded by Professor Johnston in his "Lectures."

In some volcanic districts, more especially in Italy and Sicily, ammonia is given off in combination generally with some acid, most frequently in the form of sal-ammoniac.

According to Berzelius, when organic substances which contain no nitrogen are oxidized in the air, ammonia is not unfrequently formed.

According to Faraday, when certain oxidized substances are decomposed in the air by means of potassium, or when metals are rapidly oxidized by means of nitric acid, a variable quantity of ammonia is produced.

When a current of moist air is made to pass over red hot charcoal, carbonic acid and ammonia are simultaneously produced.

Ammonia has been detected by Berzelius in the compact iron-ore of Dannemora, probably in consequence of the gradual transition of part of the protoxide into deutoxide, by decomposition of the water, the hydrogen of which combines with the nitrogen of the air.

The latter facts may serve to explain the former in a satisfactory manner. For at great depths beneath the surface of volcanic regions, combustible, or at least oxidizable, matter almost necessarily exists; and, as the presence of steam, mixed with a limited quantity of air, is equally probable, these conditions are sufficient to account for the production of a certain quantity of ammonia.

The *possibility* of the nitrogen of the air combining with hydrogen to form ammonia being thus proved, I shall proceed to the account of Mulder's experiments, in order to arrive at something more definite than mere posibility, and even than probability.

1°. Powdered charcoal, recently heated to redness and carefully allowed to cool, was mixed with pure warm water in a bottle, one-eighth part only of the bottle being filled with the mixture. After about three months, the charcoal, mixed with caustic potash, gave distinct indications of ammonia.* When the charcoal was treated with water, this remained entirely colorless, a proof that no apocrenate of ammonia was formed. This is of importance, because it results from the experiments mentioned above, that apocrenate of ammonia does not favor vegetation, which might be considered as the cause why plants refused to grow well in a mixture of charcoal and ashes as stated above.

The presence, however, of an organic substance seems to be almost a requisite to the commencement of the formation of ammonia.

2°. Ammonia was also found to be abundantly produced when humic acid and water, both free from ammonia, were kept in a bottle, partially filled, and closed with a glass stopper for six months.

It may be as well here to mark that I saw in Professor Johnston's laboratory a bottle containing dry humic acid which had been closed for a long

* It was previously ascertained that the charcoal itself produced no ammonia whatever when treated with caustic potash.

time. On examination for a certain purpose, I found that a portion of a soluble colored salt of ammonia had been formed.

3°. When pure potato starch was substituted for humic acid, the action in the bottle became so vehement, that by merely touching the stopper, it was with violence thrown out of the neck. The mixture had a strong smell of cheese, and gave most abundant proof of the presence of ammonia.

Gum Arabic, cane sugar, milk sugar, all gave the same results.

Mulder farther found that when pure milk sugar or cane sugar, repeatedly re-crystallized, was dissolved in pure water, in a glass-stoppered bottle, about one-eighth of the bottle being filled with the mixture, after a few days mould appeared, which, by dry distillation, yielded ammonia abundantly.

Upon the foundation of these *fair* experiments, Professor Mulder proceeds to state that the arable soil is precisely in the same condition as the charcoal, the humic acid, &c. were in his experiments, and that really a continual formation of ammonia from the nitrogen of the air is going on in the soil, whence is explained the quantity of nitrogen in arable land, even where no ammonia is added extraneously, and the presence of nitrogen in plants grown in unmanured soils.

Mulder also found that a number of little plants were produced in solutions of potato starch, acetate of potash, nitrate of potash, binoxalate of potash, &c., even in chloride of calcium, sulphate of soda, and common alum. I have myself seen them in solutions of neutral tartrate of potash and of sulphate of alumina.

These plants were submitted by Mulder to the skilful botanist, Dr. Miquel of Rotterdam, for examination, who was able to recognize them as belonging to the genera *Cryptococcus*, *Alvina*, *Hygrocrocis*, *Sirocrocis*, and *Leptomitus*.

It has been objected to these results, that only such a solution of tartaric acid as contains decaying organic matter will produce mould plants, of which the *supposed* germs would thus find their proper food, and that the plants produced in Mulder's experiments owed their origin to a similar source. This objection hardly requires any serious consideration. Certainly no chemist, and Mulder least of all, would allow such a source of error to exist. I am not only convinced that nobody who understands the importance of the subject will consider such a mistake possible, but I am even inclined to think that the party by whom this objection has been advanced has not done so seriously.

But, moreover, whence, I would ask, could the decaying organic matter come in a solution of chloride of calcium, alum, or sulphate of soda in pure distilled water?

I think it almost certain that any solution of an organic acid or salt, in a partially filled bottle, however well protected from the surrounding air, will produce mould plants; but I take the liberty of entirely rejecting the obsolete idea of a vital force *as a concrete*, to ascribe this phenomenon to the meeting of the four organic elements in the nascent state, possessing their original, unweakened, molecular forces. This, however, would lead me too

far; and I am satisfied to have shewn the weakness of the abovenamed grounds, upon which it is assumed that Professor Mulder has possibly been deceived by his own careful experiments.

I shall add one or two more conclusive experiments made by Mulder upon this subject.

Powdered charcoal, mixed with one per cent. of wood ashes, was placed in two glass vessels. To one, ulmic acid from sugar was added, and both vessels were placed in an atmosphere free from ammonia. Three brown beans were sown in the former (charcoal and ashes) and three white beans in the latter. The first grew very poorly, the second very luxuriantly. After twenty-four days the plants were taken out, the roots completely and cautiously washed, the whole dried and weighed. Both the remaining charcoal and the mixture of ulmic acid and charcoal gave off ammonia abundantly when distilled with caustic potash.

The three brown beans dried at	212°	weighed	1.277	grammes.
The three plants produced	,, 212°	,,	1.772	,,
The three white beans ...	... ...	,,	1.465	,,
The three plants produced	... ...	,,	4.167	,,

The ratio of increase in weight was therefore—

Brown beans, ...	1—1.39
White beans, ...	1—2.84

The proportion of ash left by

The brown beans was	3.7 per cent.,	their plants	9 per cent.
The white beans was	4.7 ,,	,,	84 ,,

The proportion of nitrogen contained in

The brown beans was	27 cub. cent.	their plants	54 cub. cent.,	ratio 1 to 2
The white beans was	50 ,,	,,	160 ,,	1 to 3

The increase of nitrogen in the beans grown in charcoal and ashes, therefore, was 100 per cent., that in the beans grown in the mixture with ulmic acid, 200 per cent.

Whence plants derive their nitrogen is, according to Liebig, very clear—it is the ammonia in the air, washed down by the rain-water. But Professor Liebig himself says that *traces* of ammonia can be scarcely detected in large quantities of rain-water; and, though assuming—on what grounds is not mentioned—that a pound of rain-water contains one-fourth of a grain of ammonia, it is obvious that, by a continuous rain, only the part that *falls first* would contain this quantity, and what falls subsequently would soon be without any ammonia at all. The minute quantity of ammonia contained in the air above a field, is certainly far from being a sufficient source for all the nitrogen contained in the plants growing upon it.

But the following demonstration will shew how much more probable and natural is the explanation given by Mulder, which makes it quite unnecessary to assume, as has lately been done, humorously I suppose, *that hot solutions* of alkalis ought to be showered down to make the humic acid soluble.

All the decaying organic substances present in the soil are principally derived from the two chief constituents of organized beings—woody fibre (including starch, gum, sugar) and protein compounds. The composition of the former is either—

	C^{24}	H^{21}	O^{21}	
Or,	C^{12}	H^{10}	O^{10}	
Of the latter,	C^{40}	H^{31}	N^{5}	O^{12}

Now, in whatever way the decay of these substances in the soil be conceived—the main products being humic, ulmic, and crenic acids—there will always be a large excess of hydrogen,* which, being in the nascent state, has all its properties unweakened. It is, moreover, set free amidst a decaying and porous organic substance, with a limited access of air and at a low temperature—conditions essential to effect the production of ammonia, and to prevent that of nitric acid; and is, therefore, in the same circumstances as it was in Mulder's experiments mentioned above. Hence it will most likely give rise to the same product, *i. e.* ammonia. The decaying organic matter sets free, carbon, hydrogen, oxygen, and a little nitrogen. The carbon, obeying its strongest tendency in this condition, forms carbonic acid in so far as it can find oxygen enough present in the air, which is continually circulating through the porous soil. The small remainder of carbon, if a sufficiency of oxygen cannot be procured, will combine with part of the hydrogen, and hence the quantity of carburetted hydrogen in marshy places and stagnant waters. The remainder of the hydrogen takes the nitrogen, simultaneously liberated from the plant, and also from its intimate mixture with the oxygen in the atmospheric air, and thus ammonia is formed. This ammonia, the extraordinary affinity of which for humic, ulmic, and crenic acids is very well known, combines immediately with part of the decaying substances, when still in the state of humus, either extracting or producing humic and ulmic acids, with which it forms humate and ulmate of ammonia, so extremely soluble in water, and fit for progressive decomposition within the cellular tissue of the plants. Now, it is evident from this, that, as the said production of humic acid and ammonia is going on gradually, there are only small quantities present at the same time in the soil, that which is formed being instantly taken up by the roots. There is a continual formation and absorption of them, and thus, though no hot alkaline solutions shower down upon the soil,† though the liquid is always cold and weak, and so adapted to the tender

* It would take too much space to give diagrams here with the view of representing this, but it will be found amply explained in Mulder's work, "The Chemistry of Animal and Vegetable Physiology," part, I., pp. 171-2.

† I should not have thought it necessary to remind a chemist that humic acid is *not dissolved in water* containing a *little* ammonia; but that every atom of ammonia produced combines with an equivalent of one of the organic acids present in the soil, and that this *organic compound* is dissolved in water. It is clear that, even though the quantities of ammonia were very minute—like the traces contained in rain-water—this can have no influence upon the *solubility* of humic acid, but only *upon the quantity of humate of ammonia produced in a given time.*

extremities of the roots it is *constantly* present, and so a sufficient and nourishing supply is present wherever required.

The beautiful connection which this theory constitutes between the production and use of ammonia and the humic acids in the soil is evident, and certainly not the least of the advantages of the theory itself. It agrees remarkably well with the great rule in nature, that there is a close relation of causation between every two products whose presence is necessary to each other. The last-mentioned experiment of Mulder, shewing the luxuriance of plants grown in a mixture of charcoal, ashes, and ulmic acid, superior to those grown in mere charcoal and ashes, and, at the same time, the larger quantity of ammonia *produced* and assimilated by the former, apparently tends to solve two problems at once.

A few remarks advanced by Professor Johnston may serve here as a further support of the above-named conclusions.

The ammonia produced in the air from decomposed vegetable and animal matters can but very imperfectly be restored again and rendered available for vegetation. The greater part is washed down by the rains into the sea, and of that which is carried down by the rain into the soil, another part is further washed out and carried to the sea, and may be considered as directly lost to the soil.

What now remains in the air will undergo continual decomposition by the constant action of electricity, and much more by that of thunder-storms. Could the small part which is finally left in the atmosphere and brought down to the soil account for the whole quantity of nitrogen that is found in the plants produced? Besides, part of the small quantity of ammonia thus returned to the soil and taken up by the plants is again decomposed in their interior, and the nitrogen given off, as is *proved* to be done by the leaves of some and the flowers of other plants—a fact most strangely explained by Liebig as affording a proof *that plants get more ammonia from the air than they require for the formation of their nitrogenous constituents.*

This leads Professor Johnston to the very plausible conclusion that nitric acid is produced also in considerable quantities in the air and the soil, and that by this means, *in some degree*, is made up the deficiency of nitrogen arising from the several losses of the existing ammonia sustained in a way which prevents its being all replaced by a reproduction of ammonia. The existence of nitric acid in the soil, especially of the hotter regions, where nitrates accumulate to a great amount, is a known fact; and, though partly the same causes contribute to the diminution of this acid as are at work with respect to the ammonia in nature—viz. the washing away by the rains—yet there are so many causes of reproduction—viz. thunder-storms, putrefaction in the open air, and at higher temperatures, &c.—that, in this way, there is a much fuller compensation for the quantity which is lost.

The same writer farther states that the putrefaction of organic substances is, in temperate regions, necessary to cause the formation of nitric acid *to*

commence, but will proceed after that for any indefinite period, at the expense, apparently, *of the nitrogen of the air only*, and that the comparatively large quantities of nitric acid in the soil of hot regions is attributable to the far more rapid decay of organic matter in those climates attracting a far greater quantity of oxygen, by which that of ammonia must become proportionately less.

This action of decaying organic matter is explained by the well-known principle in chemistry, that bodies, when in a state of oxidation, excite a disposition to the same change in substances with which they are in contact, especially so if other substances are present ready to combine with the bodies newly produced; the potash, lime, and magnesia in the soil, are very apt to form a combination with nitric acid.

From the above statements it is highly probable that nitric acid contributes, as well as ammonia, to the production of nitrogen in plants; and in tropical regions there is reason to believe that a great part of the nitrogen is thus afforded, and even that nitric acid penetrates, either as much or in the state of a nitrate, into the plants. The ammonia being far more easily decomposable than nitric acid, the latter requiring a comparatively high temperature and light to yield nitrogen to plants, it appears to be in beautiful harmony with the economy of nature to change the nitrogen of putrefying substances into nitric acid, in those regions only where plants are under the condition of decomposing it again—their growth being most vigorous and rapid—their vital action intense. In the soil of temperate regions, for the same reasons, the nitrogen is, no doubt, almost all in the state of ammonia; but, from what has been said of the action of decaying substances in general, it is probable that nitrates are found in *every* cultivated soil.

The final conclusion to which we are led by this, especially from what we know to be the case in tropical vegetation, is again much in favor of Mulder's theory, that the ammonia in the soil serves as a medium or vehicle to transfer the oxygen of the air to the putrefying substances; for it renders unnecessary the assumption, that the nitric acid produced ought to be *all* reduced to ammonia again to yield nitrogen to the plants.

There are, however, many who think that we may fairly claim the preference for those theories which support aerial nutrition—that they exhibit a degree of simplicity and beauty consonant with the other works of nature.

Simple and beautiful indeed are all the works of nature in the highest degree. This we are entitled and obliged to assume for *all* of them from the parts now known to us. I do not deny, also, that a theory, in accordance with this simplicity and beauty, deserves the preference above all others, but such a theory ought to possess the advantages of being *true*, or at least *probable*, and of explaining the *whole process in all its gradations*. I am well aware that all the carbon in plants must have been originally derived from the atmosphere, and that the final results of the decomposition of organic bodies are carbonic acid, water, and ammonia. But the science of nature

has another task to perform than merely to point out *final* results. If this were its only object, we could now say that we know all that is to be known.

The simplicity and beauty, therefore, of the said theory, are only *real* if the theory gives an easy and clear explanation possessing the character of truth. This leads me to a last ground of refutation. To whom does it appear easier to conceive the decomposition of carbonic acid—whose elements are united by an affinity the strongest possible at ordinary temperatures—in plants, than that of the easily decomposable humates and ulmates of ammonia? Then experience is in full accordance with theory; for every natural philosopher must know that a molecule, whose axis is attracted in one direction only—as is the case in carbonic acid—is under the dominion of a far more intense action than if acted upon in two or even three directions, as is the case in humate of ammonia. For, considering an atom to be endowed throughout with a fixed quantity of attractive power, which is brought into action upon meeting other atoms, the part of that power used to attract in one direction must be substracted from that used in another direction, and so lead to weaken it, and to modify the coherence of the whole compound.

Now, if the complex organic product, humus, has first to pass into the state of carbonic acid before entering into the cellular tissue of the roots, would it not appear as if it were the object of nature to *increase* the labor of the cells without any apparent purpose? The leaves cannot obtain their carbon *directly* in any other form than in that of carbonic acid; and, even here, the decomposition of this compound can only take place under the influence of the sunshine. But the roots have not this powerful assistance, and at the same time they are placed in immediate contact with a substance far more easily decomposable than carbonic acid, and, supplying the four organic elements all in their nascent state, that is, possessed of all their unweakened properties. Since we know, moreover, that for the continual growth of a plant it is necessary that, along with the other elements, carbon should be continually fixed and worked upon within the plant, the theory advocated by Liebig and his followers leaves us nothing but the alternative either to assume that plants *do not grow at all* in the dark, or that the extremities and cellular tissue of the roots can do more than the leaves—can decompose carbonic acid without the assistance of the sunshine.

The former is not the case, for plants do grow in the dark, though but imperfectly, and some even become green, as some species of *Poa, Plantago,* and *Cheiranthus* in mines, (Humboldt.) The latter is directly opposed to the rash supposition advanced by the same parties, that the cellular tissue of the roots should act as mere mechanical tubes, through which the carbonic acid, water, and ammonia, are merely passing, to be decomposed on their arrival in the leaves. In this manner the cellular tissue of the roots, an organic body, would represent itself almost as a dead body without any active property;—the cellular tissue, in which the highest functions of life reside.

But, if the cellular tissue of the roots acts, and acts differently from that of the leaves, as it no doubt does,* considering the different circumstances under which the roots are placed, then nothing entitles us to assume that its actions are more intense than those of the leaves; and, much rather than suppose that they are, because they cannot be assisted by the influence of the sunlight, I would incline to think that, because of the want of that influence, and not unnecessarily to increase the labor of the cells in the roots, they are placed in immediate contact with a substance fit for easier decomposition than carbonic acid, and supplying all the necessary organic elements in the nascent state.

This view I venture to call comprehensible, and, as to its simplicity, let us imagine the humate of ammonia—of which the constituents have their forces in a dormant state in consequence of their combination—to be decomposed. Then the four elements of which the organic part of all organs is understood to be built up are at once set free, and, being in their nascent state, endowed with all their original unweakened forces, find themselves in a condition to form such new combinations as are necessarily provoked by the conditions in which they are placed at the moment of their liberation. From all that we yet know of the works of nature, we see that wherever *one* substance, from *one* source, can with *equal* facility serve her aims, she, with wise economy, never employs *two* from *two* sources. Here the facility with which that aim can be attained through *one* substance is apparently still *greater* than that which would attend the use of two substances obtained from two sources; and as, besides, both induction and actual experiments quoted before go to prove that the organic substances in the soil are, *as such*, taken up by the roots, I think myself compelled to call this theory, really consistent with the simplicity of the actions of nature, comprehensible, and preferable to the opposite one, resting chiefly on uncertain calculations of probabilities and confessions of individual importance to give an explanation to certain phenomena which is different from the cherished assumption, without even any serious attempt to confirm that explanation by direct experiments.

The fear of taking up too much of the valuable space of this Journal alone makes me stop here, without further advancing my independent opinions; and it is my sincere hope that chemists and physiologists will, more and more, follow the example of such as sincerely attempt to walk on a *firm* ground, as it is only in this way that we can hope to prosecute, successfully, the study of these most interesting sciences.—*(From the Journal of Agriculture, and Transactions of the Highland Society of Scotland for October*, 1845.*)*

* Liebig's theory renders it necessary that the cells af the roots should act either with *less* or with *more* energy than those of the leaves. That it is *less*, and, therefore, allow the fluids to pass unchanged to the leaves, is contrary to the fact that the oxygen given off by the leaves is always less in bulk than the oxygen taken up by them; that it is *more*, is an arbitrary assumption, and is also in opposition with the fact, a negative one I confess, that, hitherto, oxygen has not been found to be given off by the roots.

Monthly Proceedings of the Society.

(Wednesday, the 14th of January, 1846.)

The Honorable Sir Lawrence Peel, Vice-President, in the Chair.

The minutes of the last General Meeting were read and approved.

Members Elected.

The gentlemen then proposed, were duly elected Members of the Society, viz.—

Messrs. Thomas Watkins, Wm. Cockburn, and G. M. Gasper.

Candidates for Election.

The names of the following gentlemen were submitted as candidates for election :—

Lieut. Hugh James, Deputy Collector, Larkana, Upper Scinde,—proposed by the Secretary, seconded by Dr. Huffnagle ;

Baboo Gooroochurn Sein, Calcutta,—proposed by Mr. W. G. Rose, seconded by Mr. C. Congreve ;

Baboo Bindabun Misry, Calcutta,—proposed by Mr. W. G. Rose, seconded by Mr. C. Congreve ;

Major Joseph Ferris, C.B., Commandant Bundelkund Military Police,—proposed by Mr. R. Lowther, seconded by the Secretary :

Thomas Sutherland, Esq., Calcutta,—pro[illegible] Joseph Agabeg, seconded by Dr. Huffnagle.

Election of Office Bearers and Revision of Standing Committees.

The Secretary intimated, that this being the Anniversary Meeting, the election of Office Bearers and revision of Standing Committees for the current year, would have to be determined ; whereupon it was unanimously agreed, that all the Officers of the past year, be re-elected. Further, that the name of Mr. Owen Potter be added to the Cotton Committee ; and Mr. J. W. Laidlay to the Committee for Silk, Hemp and Flax ; that Messrs. T. F. Henley, J. W. Laidlay, and W. Hammill be requested to act on the Nursery Garden Committee, in the room of Messrs. W. Storm and H. W. Lake, gone to England ; and that the names of Messrs. Laidlay and Henley be

added to the Fruit and Kitchen Garden Committee, in the room of Messrs. Storm and Piddington.

It was then proposed by the Hon'ble the Chairman, seconded by Dr. Huffnagle, and nnanimously resolved :—

That the best thanks of the Society be given to the Honorary Secretary, for the disinterested labor and attention he has bestowed on the affairs of the Agricultural and Horticultural Society of India, during the past year.

Presentations to the Library.

1. Loudon's Encyclopœdia of Plants. *Presented by G. Wood, Esq.*

2. Reports of the Bombay Chamber of Commerce for the 2d, 3d, and 4th quarters of 1844-45.

3. Journal of the Asiatic Society of Bengal, No. CLXIV. *Presented by the Society.*

Garden and Museum.

1. An assortment of vines, figs, and peach trees. *Presented by J. T. Juritz, Esq., on behalf of the Cape of Good Hope Agricultural Society.*

The Secretary mentioned, that this assortment had arrived in a very deplorable condition, a few of the fig trees and vines only having any signs of life : these are now being carefully treated at the Nursery Garden.

2. A few bulbs of tulips, hyacinths, and lily of the valley, and some mushroom spawn. *Presented by F. W. Russell, Esq.*

3. A quantity of China tea seed, from the Kumaon Nurseries. *Presented by Dr. Wm. Jameson, Supt. Botanic Gardens, N.W.P.*

4. Seed of a newly discovered variety of melon. *Presented by Dr. Wallich, on behalf of Col. Stacy.*

In his letter accompanying this seed, Col. Stacy writes, "I havo called it 'Toomree' (a gourd used by fishermen to support their nets), because of its very peculiar shape.

My request to the Society is, that they will send a few seeds to the Bhauglepore and Lucknow Gardens, and give the remainder only to such gentlemen as may be good gardeners, because there is but little seed, and I may not be able to procure you more."

5. A small quantity of seed of the Angola grass, *(Panicum spectabile.) Presented by George Gardner, Esq., Supt. of the Royal Botanic Garden, Peradinea, Ceylon.*

The following is an extract of Mr. Gardner's letter, descriptive of this useful grass :—

"Having just succeeded in importing from Brazil a new fodder grass, I beg leave to enclose for your Society, a small quantity of its seed, which arrived here by the last overland. By the previous one, I also receivod a small portion, most of which has vegetated. It is the *Panicum spectabile* of Martius, was introduced from Angola to Rio de Janeiro many years ago, and is now

tho only grass which is cultivated for fodder, having quite superseded the Guinoa grass. During my extensive travels in Brazil, I found it cultivated over nearly tho whole of that immense empire. It is the *Cadpim de Angola* of the Brazilians, literally *Angola grass.* I have now, I have no doubt, secured it to Ceylon, and I trust that you and Dr. Wallich, to whom I have also sent a litte seed, may do the same for the continent of India. It is said not only to be a more nutritious grass than the Guinea grass, but it produces a larger crop, and the plant is readily propagated by cuttings."

The Secretary mentioned, that a portion of this seed was under trial at the Nursery, and he was about to send the remainder to the different Branch Gardens.

6. Two fleeces, shorn from yearling lambs, the produce of Patna ewes by an imported Southdown ram. *Presented by F. Skipwith, Esq.*

Annual Reports.

The Annual Report of work done by the Society during the past year was submitted ; also a report from the Finance Committee, with various statements connected with the receipts and disbursements of 1845. These papers were transferred for publication in the nnmber of the Journal, (Part IV. of Vol. IV.) now in the press.

Horti-Floricultural Exhibitions.

Two reports from the Garden Committee regarding the Flower Show held on the 30th December last, and the Vegetable Show, which is to be held on 2nd February, were next read. In the remarks appended to the list of prizes, amounting to Rs. 121, awarded at the Flower Show, it is mentioned, that the colleotion of exotics then brought forward, was by no means a good one. The best specimens were among the dahlias, crysanthemums, geraniums, and balsams. A single plant of Cereus truncatus in full blossom was much admired for its elegance ; and there were also a few fine plants in blossom, of Euphorbia jacquiniflora, Maurandyas and Justicias (carnea and coccinea). Altogether it was the poorest Show of last year.

In their second report, tho Committee submit a list of prizes, to tho extent of three silver medals and 144 rupees, for the next Show of Vegetables and Fruits. They subjoin a memorandum of the amount disbursed during 1845, as prizes under this head, and beg to recommend, that a similar sum, 400 Rs., be placed at their disposal, for prizes for the current year.

The reports of tho Committee were confirmed.

Metcalfe Hall.

Tho Secretary read two communications from Dr. Huffnagle and Mr. Rustomjee Cowasjee, intimating their wish, that their loans of 500 rupees for two years without interest, which were announced at the last General Meet-

ing, might be transferred as *donations* to the funds of the Society, to assist in meeting its proportion of the debt on the Metcalfe Hall.

Resolved :—That the *special* thanks of the Society be given to Messrs. Huffnagle and Rustomjee Cowasjee, for their handsome donations.

Communications on various subjects.

The following letters and papers were also submitted :—

1. From Dr. Wallich, presenting on the part of Mr. Ross, Head Gardener, H. C. Botanic Garden, a long communication, containing useful practical hints respecting the sowing of seeds, and other particulars connected with the Flower and Kitchen Garden.

2. From C. B. Taylor, Esq., offering some further remarks on the subject of turning the Nerium Indigo to practical account.

3. From T. B. Mactier, Esq., forwarding an account of the last Horticultural Exhibition of the Cuttack Branch Society, and adding a few observations about certain cultures in the Branch Garden.

These three communications were referred to the Committee of Papers.

4. From George Scott Russell, Esq., Secretary Society of Arts, forwarding the silver Isis Medal awarded to Numboocomar Paul for his clay bust of the late Dr. Carey.

5. From Dr. Esdaile, Secretary Branch Society at Hoogly, applying for the usual annual donation of fifty rupees and two silver medals.—Complied with.

6. From Mr. Fenwick, enclosing copy of a letter which he has addressed to Mr. H. C. Tucker, on certain points connected with the publication of his Handbook of Agriculture, and requesting, that it may be laid before the Society.

Resolved :—That the Meeting does not consider it expedient to interfere with any arrangements of the Committee of Papers, for the publication of the work.

(Wednesday, the 11th February, 1846.)

C. K. Robison, Esq., Vice-President in the Chair.

The minutes of the last General Meeting were read and confirmed.

Members Elected.

The gentlemen then proposed, were duly elected Members of the Society, viz.—

Lieut. Hugh James, Baboos Gooroochurn Sein and Bindabun Misry, Major Joseph Ferris, C.B., and Thomas Sutherland, Esq.

Proceedings of the Society.

Candidates for Election.

The names of the following gentlemen were submitted as candidates for election :—

The Rev. Dr. Carshore, Chaplain, Lucknow,—proposed by Capt. G. E. Hollings ;

Adolphe Delessert, Esq., Ottar Factory, Tirhoot,—proposed by Dr. Wallich ;

T. B. Mactier, Esq., Civil Service, Cuttack,—proposed by Mr. H. Brownlow ;

Robert Bullen, Esq., Merchant, Mauritius,—proposed by Mr. James Cowell ;

E. Wingrove, Esq., Merchant, Calcutta,—proposed by Mr. R. Dodd ;

The above nominations were seconded by the Secretary.

Presentations to the Library.

1. The Calcutta Journal of Natural History, No. 24. *Presented by Dr. McClelland.*

2. Third half-yearly volume of the Transactions of the Royal Agricultural Society of Jamaica. *Presented by the Society.*

Garden and Museum.

1. An assortment of deodar, pinus, cupressus, and other hill seeds. *Presented by Dr. Jameson, Supt. Botanic Gardens, N.W.P.*

These seeds are available to Members.

2. Specimen of Sicilian Sumach, and a hide tanned by it ; also a specimen of Valonia. *Presented by Dr. Wallich.*

3. Specimen leaves of two kinds of Munjeet, the produce of the Saugor District ; and cloth dyed by the root of one kind. *Presented by Lieut. Colonel Sleeman.*

4. Specimen of cotton, the produce of his garden at Kotra. *Presented by Capt. J. C. Brooke.*

Captain Brooke mentions that the trees from which this cotton was taken were so covered with boles that they had to be propped up, and he adds, "a very severe frost set in about the 10th of December, which has killed most of the trees, though I had taken the precaution of placing grass over them all. The cotton has been thus partially injured. The seeds have been taken out by the hand."

Mr. Owen Potter, to whom this cotton was referred, remarks "that it is too small a sample to be a good criterion, that it is of good color naturally, though slightly stained. The staple is about equal in length to that of good Broach or Surat cotton, but coarser, and more tender and woolly, which two last faults are perhaps attributable to its being too long on the tree, after the cotton was ready for gathering."

5. A pretty collection of exotic annuals, and a beautiful specimen of Poivrea coccinea, were also placed on the table, the produce of the garden of Mr. R. Wood, junior.

Presentation to the Metcalfe Hall.

Read a letter from C. K. Robison, Esq., accompanying two handsomely carved tables of Teak and Sissoo, the produce of the H. C. Botanic Garden, Calcutta, intended for the Society's apartments, Metcalfe Hall.*

The best thanks of the Society were given to Mr. Robison for this handsome present.

Horticultural and Floricultural Exhibitions.

A list of native gardeners to whom prizes were awarded, to the extent of 134 rupees and a silver medal, at the exhibition of Vegetables and Fruits held on the 2d February, was next submitted. In the remarks appended to this list, it is stated, that both in quantity and quality, the Vegetables exhibited on this occasion were exceedingly good, particularly the foreign varieties. The display of the finer and more delicate sorts of cabbages—the Battersea, early York and Savoy—was excellent; there were also several baskets of the *red* cabbage. The show of carrots (altringham and long orange,) was good; the endives exceedingly well blanched; onions, peas and American squash, likewise of good quality. At the last year's Show, there were only two or three good specimens of peas, but at this, there were upwards of twenty baskets. The potatoes were likewise superior to those of the last four or five years, but not sufficiently good for the silver medal, which had been offered for the best sample. The same remark is applicable to the Windsor beans. The Scotch kale, turnips, knole kole, beet and celery, though not equal to those enumerated above, were tolerably good. In the latter, especially, there was a marked improvement, they were blanched well and rather firm. The cauliflowers were not so good as specimens exhibited on former occasions, being indifferently grown, and the heads wanting compactness.

The assortment of indigenous vegetables was limited; the best specimens were those of the Tenasserim yam, maize, capsicums, brinjalls and Assam bean.

Among the Fruits, there were good samples of pomegranates and sapotas; also a few baskets of oranges grown in the neighbourhood of Calcutta; prizes were given for custard-apples, pine-apples, and papeeyahs, they being out of season: rewards were also offered for rose-apples, loquots, strawberries and sour-sop, but there was not a single specimen of any.

A schedule of prizes for the next Flower Show was also submitted by the

* For this letter, see Correspondence, page 15.

Garden Committee. The Committoe suggest, that the Show be held on Tuesday, the 24th February, at 11 A. M.

The list and day of exhibition was confirmed, and it was further agreed :—That the following gentlemen be requested to officiate as judges, viz.—Mr. Robison, Capt. Burnett, Capt. Munro and Mr. Dodd.

Nursery Garden.

A report from the Committee of a late visit to the Nursery, was likewise read. The Members state, that since their last visit, about four beegahs of ground have been planted out with the Singapore and China varieties of cane, as previously agreed on; that many additional fruit trees have been added to the orchard; and that a spot is in course of preparation for vines of superior sorts, which have been lately received. They also refer to the progress making in the laying down of walks throughout the flower-garden, and to the erection of a small conservatory. The Committee, lastly, alludo to having received an application from the Overseer for an increase of salary. They state, that although they are not prepared at present to suggest a complianco with this request, yet, taking into consideration, that the actual cost for the garden during the past year has not exceeded the sum of Rs. 536* inclusive of extraordinary charges, and to mark their sense of the attention bestowed upon the ground under his charge, and his steadiness of conduct generally, they have no hesitation in recommending to the Society, that tho sum of ono hundred rupees be awarded to Mr. D'Cruze as a *bonus*.

* Disbursements, Rs.	2,227
Proceeds, ... ,,	1,691
Balance, ...	536

At the close of tho reading of the above report, the Secretary, after remarking on the length of time Mr. D'Cruze had been in the service of the Society, extending over a period of seven years, and referring to the satisfaction which he had invariably afforded, gave the following notice of motion for the next General Meeting :—

"That the salary of tho Overseer of the Society's Nursery Garden be increased from sixty to eighty rupees per mensem."

Report on Wool, the produce of a cross between a Patna Ewe and Southdown Ram.

The Secretary mentioned, that at the last Meeting, Mr. Skipwith presented two fleeces shorn from yearling lambs, the produce of Patna ewes by an imported Southdown ram, bred by Mr. Ricketts of Chittagong. He had now the pleasure to submit a favorable report on these fleeces, drawn up by a gentleman who has had considerable experience in the growth and cleaning of the staple in the Australian Colonies, and which had been obtained through

the assistance of a Member of the Society.—(This report will be found in Correspondence department, page 10.)

Communications on various subjects.

The following letters and reports were likewise submitted:—

1. From Dr. Wallich, furnishing copies of further correspondence with Mr. Teil, respecting certain experiments with Sumach, also a communication from Dr. Royle on the same subject.

2. From Lieut. Colonel Sleeman, forwarding specimens of two kinds of Munjeet, the produce of the Saugor District, and giving some particulars about their growth, the purposes to which they are applied, &c.

3. From Dr. Wight, enclosing a letter to his address from Mr. Fischer of Salem, giving further particulars regarding the growth and manufacture of the Nerium Indigo.

Dr. Wight adds the following gratifying information regarding Cotton experiments at Coimbatore:—

"I am happy to say, that our Cotton experiments here seem to be taking a very favorable turn; some of our fields have already yielded 700lbs. per acre, and the crop does not seem half over. Unfortunately our farms are small, but I trust we shall be better provided in that way next season. Much seems to depend with us on the sowing season. The early sown fields, which had the benefit of showery weather for the first few weeks, are yielding those large crops; the later sown ones, owing to a very decided and long drought at the breaking up of the S.W. Monsoon, and the late setting in and scanty rains of the N.E., are all very poor.

The Cotton is decidedly the best we have yet grown in India, and the seed fully as well grown as that obtained from America, which has not hitherto been the case."

4. From Major Napleton, Secretary Bhauglopore Branch Society, giving an interesting report of an excellent exhibition of Flowers and Vegetables which was held at that station on the 30th ultimo.

The above communications were referred to the Committee of Papers.

5. From Cecil Beadon, Esq., Under-Secretary Government of Bengal, transmitting copy of a letter from the Secretary to the Government of Bombay, in which is conveyed a request for a further supply of silk-worm eggs, and requesting the Society to undertake the procuring and packing of the same.

The Secretary was requested to use his best and early endeavors to meet this application.

6. From H. C. Tucker, Esq., enclosing copy of a letter to his address from Mr. Fenwick, and his reply thereto, respecting the publication of Mr. Fenwick's Vernacular Hand-Book of Gardening.

The Meeting was unanimously of opinion, that under all circumstances, it would be more advisable to adhere to the original arrangement of the Com-

mittee of Papers for printing the work, than to entertain the mode of publication suggested by Mr. Fenwick.

7. From Geo. Gardner, Esq., Supt. Royal Botanic Garden, Ceylon, advising dispatch of a quantity of Coffee seed for transmission to Mr. Vansittart, Supt. of Deyrah Dhoon.

The Secretary stated, that this seed had been received, and he had placed himself in communication with Mr. Vansittart, as to the best mode of forwarding it.

8. From the Rev. Dr. Carshore, stating, that he has taken charge of the Lucknow Garden during the absence of Capt. Hollings, and acknowledging the receipt of a small assortment of seeds, forwarded for the use of the Garden.

For all the above communications and presentations, the best thanks of the Society were accorded.

(Wednesday, the 11th March, 1846.)

The Honorable Sir J. P. Grant, President, in the Chair.

The minutes of the last General Meeting were read and confirmed.

Members Elected.

The gentlemen then proposed, were duly elected Members of the Society, viz.—

The Rev. Dr. Carshore, Messrs. Adolphe Delessert, T. B. Mactier, C. S., Robert Bullen, and E. Wingrove.

Candidates for Election.

The names of the following gentlemen were submitted as candidates for election :—

F. Bellairs, Esq., Merchant, Calcutta,—proposed by Mr. Dodd, seconded by the Secretary.

W. H. Belli, Esq., Civil Service,—proposed by Dr. Huffnagle, seconded by Mr. Adam F. Smith.

John Gifford, Esq., (firm of Jamieson & Co., Calcutta,)—proposed by Dr. Huffnagle, seconded by Mr. Smith.

E. G. R. Fane, Esq., Madras Civil Service,—proposed by Mr. C. K. Robison, seconded by the Secretary.

Lieut. and Adjutant Owen, 11th Regt. Madras N. I.,—proposed by Mr. Robison, seconded by the Secretary.

Presentation to the Library.

Journal of the Asiatic Society, No. 165. *Presented by the Society.*

Garden and Museum.

1. A small quantity of American Sumach (or Dividivi) Seed; and a few papers of Mahogany Seed; both the produce of the Calcutta Botanic Garden. *Presented by Dr. Wallich.*

Dr. Wallich states, that this seed has been very lately gathered; he recommends the Mahogany to be sown with as little delay as possible, it being a very perishable seed; "no introduced timber tree," observes Dr. Wallich, "deserves being spread over this country more than the Mahogany; it is a noble tree, of quick growth, and the wood is as good as the Domingo wood, from low situations."

These seeds are available to Members.

2. Specimens of Coffee, the produce of his garden at Burkaghur, from trees of four and seven years old. *Presented by Colonel J. R. Ouseley.*

3. Specimens of Raw Silk, the produce of the Sircar Gardens at Bangalore. *Presented by Capt. F. S. Gabb, Secretary to the Madras Agricultural Society.*

4. Model of a Tirhoot Drill Plough. *Presented by H. Piddington, Esq. on behalf of A. Delessert, Esq.*

5. Specimens of Nerbudda and Soane Teak; also specimens of "Khurhur" and "Dangun" wood. *Presented by Colonel H. C. M. Cox.*

Nursery Garden.

The subject which first came before the Meeting, had reference to the motion, of which notice was given at the last Meeting by the Secretary, to the effect, that the salary of the Overseer of the Society's Nursery Garden be increased from 60 to 80 rupees per mensem. After a few remarks, the Secretary agreed to withdraw his motion in favor of the recommendation of the Garden Committee, for the award of a bonus of one hundred rupees to Mr. DeCruze. The latter proposition was accordingly seconded by Mr. Staunton, put to the vote, and carried.

A report was next read from the Garden Committee, in continuation of that made at the last Meeting, suggesting that a sum, not exceeding three hundred rupees, be voted for the purpose of putting the Overseers's bungalow into thorough and durable repair, and making sundry desirable improvements thereto, as detailed in their report. The Committee observe, that an estimate, amounting to 180 rupees, had been given in by the Overseer, but as this provides only for a partial repair to the building, entailing, most probably, the necessity of a further call three or four years hence, they deem it

more advisable, as eventually more economical, to recommend tho expenditure of the larger sum.

It was proposed by Dr. Huffnagle, seconded by Mr. Adam Smith, and agreed,—that the report be confirmed.

Exhibition of Flowers.

A list of the prizes, amounting to Rs. 120, which were awarded at the Show of Flowers held on the 24th February, was submitted. In the remarks appended to the list, it is mentioned, that this Show was undoubtedly the best that has yet taken place, exhibiting a marked improvement on the exhibition of February, 1845. The collection of pinks was large, and included many well formed flowers; of oxalis, larkspur, phloxes and roses, there was also a good show, and a few pretty specimens of sweet-williams. The assortment of hearts-ease was large, (raised principally from American seed) but with few exceptions, the flowers were wanting in size and perfection. Among the Verbenas, were two newly imported species, viz:—*Drummondii* and *Corolla albida*. Of sweet peas there were only two plants, of these, one was in flower, being the first that has yet been exhibited. There were somo good looking plants of Maurandya Barclayana, Begonias of sorts, German asters, Clarkias, Portulacas, and Euphorbia jacquiniflora. The dahlias were poor, tho soason being too advanced for them; the collection of salvias, pentstemons, lupins, wall-flowers, stocks, and antirrhinum, was also very indifferent, while thero was not a single specimen of carnation.

In addition to the collection enumerated in the printed list, a few rarer exotics were exhibited, viz. Blotia verecunda and Epidendrum crassifolium, among the Orchidaceæ; Hyacinths, Iris Hungarii, Lilium longifolium, and Platystemon Californicum. The latter plant, Captain Munro states, was found very difficult to be raised even in England.

Captain F. C. Burnett and Captain Wm. Munro acted as judges. The prizes wero distributed by C. K. Robison, Esq.

Award of an Honorary Member-ship to Dr. Wallich.

The Secretary next read a communication from Dr. Wallich, requesting, that in consequence of his approaching departure from the country, his name might be removed from tho list of contributing Members of the Agricultural and Horticultural Society of India. The Secretary said, that considering the length of time Dr. Wallich had been connected with the Society, and the services he had rendered it, he felt it to be his duty to bring his resignation prominently before the Meeting.

It was then proposed by Mr. Staunton, seconded by Dr. Huffnagle, and unanimously resolved:—

That tho Society receives with regret this announcement of Dr. Wallich's separation from it,—that it entertains a high sense of the services which he

has rendered to it from the period of its formation—and expresses its hope for his health and prosperity in Europe.

It was further proposed by the Honorable the President, and unanimously resolved, that Dr. Wallich's name be enrolled on the list of Honorary Members of the Society.

Dr. Carey's Bust.

The Secretary next submitted, certain estimates and drawings of a pedestal for the Bust of the Rev. Dr. Carey, when it was agreed, that Dr. Huffnagle, Mr. Staunton, and the Secretary, be a Committee to make the necessary arrangements for completing this testimonial.

Coffee Cultivation in Chota Nagpore.

A communication was read from Colonel Ouseley, Governor General's Agent, S. W. Frontier, forwarding the specimens of Coffee alluded to among the presentations. Colonel Ouseley mentions, that these samples are the produce of his own garden; and he hopes next year, when the trees will bear, to send a specimen of the produce of the Government Experimental Garden. The Coffee plant, Colonel Ouseley adds, appears to like the soil and climate wonderfully.

The Secretary mentioned, that Mr. James Cowell had obligingly acceded to his request in furnishing a report on this Coffee, a copy of which he had forwarded to Colonel Ouseley.*

Silk Culture in the Mysore Country.

A letter from Captain Gabb, Secretary to the Agricultural Society of Madras, forwarding the specimens of Raw Silk, before referred to, was next read. The copy of the Proceedings therein alluded to, was also submitted.

The specimens, which were much admired by the Members present, were referred to the Silk Committee for report*; and Captain Gabb's offer to furnish copy of Captain Haine's detailed report, was thankfully accepted.

Arrival of Carolina Paddy.

Dr. Huffnagle having announced to the Meeting the arrival of the large supply of Carolina Paddy, which his firm had been requested by the Government of Bengal to procure, with the view of meeting a requisition from the Commissioner of Arracan; it was agreed, that the Secretary should place himself in communication with the Secretary to the Government of Bengal, with the view of obtaining a small proportion of this supply, if available, in

* These reports, and other communications connected therewith, will be found in the Correspondence department.—Eds.

order to meet the many applications which had been made to the Society, for this superior description of paddy.

Communications on various subjects.

The following papers and letters were also submitted :—

1. From H. Brownlow, Esq., C. S., dated Cuttack, 1st March, announcing the complete success attending the dispatch of a number of cuttings, which were sent to him by dawk banghy, packed in a plantain box. Mr. Brownlow thus writes on the subject :—

"It will please you very much to hear of the *entire success*, which has attended your kind dispatch of cuttings on the 23d January last; *every one* of the Poinsettia and Ipomœa rubra-cerulea cuttings is flourishing. They were put in on the 29th January, and there has not been *one* failure. They were struck of course under a glass. Some were put in a shady part of the garden, and some in a northerly verandah. The latter struck sooner, and became healthier in appearance. Those from the garden, therefore, were removed to the verandah, and *all* are flourishing now to my heart's content. This speaks well for the *plantain box* system, recommended by Colonel Stacy, and I warmly support it. Perhaps you would kindly give me another trial of some more cuttings of any kind, which you think most beautiful."

2. From H. Rehling, Esq., dated Rungpore, 29th January, enclosing three interesting communications, viz :—

(i.) On experiments made with certain descriptions of seeds received last year from the Society.

(ii.) Replies to the queries on the subject of manures, printed in the second volume of the Society's Journal.

(iii.) Remarks regarding the culture of tobacco and other useful plants in the Rungpore district.

3. From J. W. Payter, Esq., dated Bogra, 15th February, giving the result of his experiments on Sugar-cane with Guano obtained from the Society.

4. From the Deputy Secretary, giving the result of experiments on the Bussorah Rose with Guano obtained from the Society.

The above communications were referred to the Committee of Papers. For these and for the other letters and presentations, the best thanks of the Society were accorded.

Extra Establishment.

At the close of the Meeting, the Secretary brought to notice, that a few extra servants were now required to protect the Society's property, keep the furniture in order, &c.; when it was agreed, that an additional sum of sixteen rupees per mensem be allowed for that purpose.

(Wednesday, the 8th April, 1846.)

C. K. Robison, Esq., Vice-President, in the Chair.

The minutes of the last General Meeting were read and confirmed.

Members Elected.

The gentlemen proposed at the last Meeting, were duly elected Members of the Society, viz.—

Messrs. F. Bellairs, W. H. Belli, C. S., John Gifford, E. G. R. Fane, Madras C. S., and Lieut. W. G. Owen, 11th Regt. Madras N. I.

Candidates for Election.

The names of the following gentlemen were submitted as candidates for election :—

Alexander Duncan, Esq., Choukeedangah Colliery,—proposed by Mr. T. Watkins, seconded by Mr. M. Cockburn.

Henry Torrens, Esq., Civil Service,—proposod by the Secretary, seconded by Mr. C. K. Robison.

G. G. Mercer, Esq., Indigo planter, Etawah,—proposed by Dr. A. Greig, seconded by tho Secretary.

Wm. Andorson, Esq., Bagnan,—proposed by Mr. Robison, seconded by Capt. Wm. Munro.

Presentations to the Library.

1. Tho Gardener's Dictionary. *Presented by A. G. Harris, Esq.*

2. The Tenth Annual Report of the London E. I. and China Association. *Presented by the Association.*

3. Journal of tho Asiatic Society of Bengal, No. 166. *Presented by the Society.*

4. Report of tho Bombay Chamber of Commerce for the first quarter of 1845-46. *Presented by the Chamber.*

Garden and Museum.

1. A further supply of American Sumach (Dividivi,) and Mahogany Seed. *Presented by Dr. Wallich.*

2. A cask containing about five maunds of Carolina Paddy. *Presented by the Government of Bengal.*

3. A small quantity of African Pod-Pepper seed. *Presented by J. Stikeman, Esq., Secy. E. I. and China Association.*

In his letter advising the dispatch of this seed, Mr. Stikeman states, that last year, the Bombay Government sent to the Association somo Pod-Pepper for sale, to test its properties and market value. "It was most

unfortunately," he adds, "a failure, owing principally to want of a deep red color. The brokers, Messrs. Morry and Son of Fenchurch Street, who managed the sale, furnished me with a sample of African Pod-Pepper from Zanzibar, a portion of which I have sent to Bombay for their guidance; and I now do myself the pleasure of sending you a similar quantity, in the hope, that it may reach you in a proper season, and that the seeds may germinate and by possibility introduce a new variety. I am the more anxious upon this point, because, whilst the Bombay Pepper only fetched 44s. per cwt., the African Pepper was realizing £5 per cwt., and much wanted."

4. A small quantity of Munjeet seed from the Nerbudda. *Presented by Lieut.-Colonel Sleeman.*

5. An Apple, the produce of his garden at Burkaghur, Chota Nagpore. *Presented by Lieut.-Colonel Ouseley.*

Colonel Ouseley mentions, that this apple is the produce of one of the trees sent to him by Mr. Hodgson from Nepaul, four or five years ago. All the trees, as also a number of pear trees received at the same time, have blossomed this year, and Colonel Ouseley adds, "one English walnut tree has grown to about nine or ten feet high, and thrives beautifully; the Cabool walnut also grows admirably: I have about 120 trees."

6. A piece of Cow-hide tanned by Sicilian Sumach at Mr. Teil's tannery, at Kidderpore; and a piece of Bullock-hide tanned at the same place by American Sumach. *Presented by Dr. Wallich.*

7. An oblong paper-box made from Mahogany, the produce of the H. C. Botanic Garden. *Presented by the Government of Bengal, at the request of Dr. Wallich.*

8. Specimen of Coal from the Nerbudda. *Presented by Lieut. Col. H. C. M. Cox.* (For a report on this Coal see "Correspondence," page 18.)

9. Twelve pounds of Coffee, of a similar description to that submitted at the last Meeting. *Presented by Lieut.-Col. Ouseley.*

It was agreed to send three-fourths of the above supply, to the East India and China Association, with the view of obtaining the opinion of experienced dealers in the article.

10. An Apricot, the produce of his garden at Howrah. *Presented by P. Homfray, Esq.*

Mr. Homfray mentions, that the tree, from which this Apricot was plucked, bears a very great profusion of blossom every year, but it has never produced more than three or four fruit, in any one season, and none larger than the present one.

Report on Raw Silk produced at Bangalore.

A report of the Silk Committee on the specimens of Raw Silk which were submitted at the last Meeting, was read:—

Resolved,—That a copy of the above report be forwarded to the Agricul-

tural Society of Madras, and that the specimens be transferred to the Chamber of Commerce, in accordance with the roquest of tho Madras Society.

Floricultural Exhibition.

A schedule of prizes for the next Flower Show was submitted by the Garden Committee. The Committee suggest, that the Show be held on Wednesday, the 15th instant, at eleven A. M. This was agreed to, and Captains Burnett and Munro, were requested to act as judges.

Mahogany Culture at the Botanic Garden, Calcutta.

A letter from Mr. Under-Secretary Beadon, enclosing extract of a communication from the Superintendent of the H. C. Botanic Garden, dated 23d March, 1846, regarding the Mahogany box alluded to among the presentations, was next submitted.

The Secretary mentioned, that in reply to an application to that effect, he had received a copy of the report of Messrs. Shearwood, referred to in the above extract, with an intimation, that the Superintendent of the Botanic Garden had been requested to forward to the Society, a section of the trunk of the Mahogany tree from which the box has been manufactured.

The Secretary further stated, that Dr. Wallich had obligingly furnished him with a note descriptive of the mode in which the Mahogany should be treated, for the information of those Members who have been lately supplied with seed.

Value of the American Sumach as a tanning plant.

Tho papers, that next came before the Meeting, had reforence to the piece of Bullock-hide (tanned exclusively with American Sumach or Dividivi, the produce of tho Botanic Garden,) which is alluded to under the head of presentations. Dr. Wallich, who forwards this specimen, accompanies it with a communication to his address from Mr. Teil.

In connection with this subject, another communication from Dr. Wallich was read, intimating his desire of bringing "this last instance of Mr. Teil's most disinterested and valuable services, in the matter of the American Sumach or Dividivi, to the marked consideration of the Society." Dr. Wallich expresses it as his opinion, that "the high distinction of the Society's Gold Medal could not be more worthily bestowed, than upon the important labors, so readily and successfully performed for the promotion of the great object the Society has in view, by Mr. Teil of Kidderpore."

It was agreed to postpone the considoration of the above proposition till the next General Meeting.

Improvement in the Indian Churka.

The following letter from Mr. Robert Burn, regarding an improved machine, on the Churka principle, for cleaning cotton, was also read :—

To JAMES HUME, ESQ., *Secretary to the Agricultural and Horticultural Society of Bengal, Calcutta.*

SIR,—Having just observed an advertisement made by the Agricultural and Horticultural Society of India, in which the Society's Gold Medal, together with Rs. 500 reward, is offered to any person who may succeed in improving the native Churka, so as to make an efficient and serviceable machine for cleaning cotton,—I beg leave to state, that I think there is a fair prospect of the object desired by the Society, being attained. The improvement I have made on the native Churka, was completed in 1843, and my brother, the Superintendent of the Government Cotton experiments, used every means to bring it to the notice of the authorities at Bombay, and the machine has been laying at the Military Board Office ever since, waiting a report.

I now beg to request the favor of the Society making application to the Government of Bombay, for the Churka to be sent round to Calcutta, with a view to its competing for the above rewards. As I came out to this country three year's since, solely with a view to try what could be done for the improvement of Indian Cotton, and at my own expense and responsibility, it will be matter of much satisfaction to me, to find that the principle of this machine, and the improvements I have made, are as highly approved of as I feel confident they merit.

Broach ; I am, &c.
14th March, 1846. ROBERT BURN.

At the close of the perusal of the above letter, the importance of the subject on which it treats was fully recognized, and it was agreed, that the Secretary should place himself in communication with the Government of Bombay, through the local Government, with the view of carrying the suggestion of Mr. Burn into effect.

Communications on various subjects.

The following communications were also submitted :—

1. From the Rev. Dr. Carshore, Acting Secretary, Branch Agri-Horticultural Society, Lucknow, enclosing an account of an exhibition of vegetables and fruits, held in that city in February last.

2. From the Rev. J. Cahusac, Acting Secretary, Branch Agri-Horticultural Society, Hooghly, forwarding a report of an exhibition of vegetables and fruits held at that station on the 19th January.

3. From J. W. Yule, Esq. of Ramnuggur, giving the result of his sowings of English cereal and other seeds, sent by the Court of Directors; also of certain other seeds received from the Society at the close of last year.

4. From Dr. A. Greig, Seetapore, giving the result of his sowings of the American, Cape, and English Flower and Vegetable seeds; also of English Wheats.

The above four letters were referred to the Committee of Papers.

5. From Cecil Beadon, Esq., Under-Secretary to the Government of Bengal, applying for Cotton seed for the use of the Government farms at Dacca.

The Secretary stated, that he had replied to this letter, expressing the regret of the Society at its inability to meet this application, not having any fresh imported seed in store.

6. From Messrs. Wrench and Son of London, forwarding an invoice of Flower seeds, shipped per *Tartar*.

7. From the Secretary, Society of Arts, London, returning thanks for the third volume of the Society's Journal.

Monthly Proceedings of the Society.

(Wednesday, the 13th of May, 1846.)

M. S. Staunton, Esq., Senior Member present, in the chair.

Tho minutes of the last general meeting were read and confirmed.

Members Elected.

The gentlemen proposed at the last meeting were duly elected Members of tho Society, viz :—

Messrs. Alexander Duncan ; Henry Torrens, C. S. ; G. G. Mercer, and Wm. Anderson.

Candidates for Election.

Tho names of the following gentlemen were submitted as candidates for election :—

Wm. Vincent, Esq., Nudzuffghur, near Cawnpore,—proposed by Mr. R. Lowther, C. S., seconded by tho Secretary.

Hugh Colquhoun, Esq., Merchant, Mozufferpore,—proposed by Mr. James Small, seconded by tho Secretary.

Presentations to the Library.

1. Madras Journal of Literature and Science, No. 31. *Presented by the Madras Literary Society.*

2. A list of trees, shrubs, plants, &c., growing in the Madras Agri-Horticultural Society's garden. *Presented by the Agricultural and Horticultural Society of Madras.*

Museum and Garden.

1. Samples of Bengal jute, bleached by a new and rapid process, invented by Col. Calvert. *Presented by Alexander Rogers, Esq.*

In reply to a communication from the Secretary, Mr. Rogers remarks, that he is unable to givo any information as to the nature of the process adopted by Col. Calvert ; the discovery, however, appears important, inasmuch that jute may now be used for many fabrics as a substitute for flax.

2. Section of a mahogany tree grown in the H. C. Botanic Garden, Calcutta, to which allusion is made in his communication read at the last meeting. *Presented by Dr. Wallich.*

3. Sample of a "species of cotton" gathered on the island of St. Martins, where it is to bo found in great abundance. *Presented by Capt. J. W. Cannon, Commander of the H. C. Schooner 'Spy.'*

Capt. Munro mentioned, that the above sample is the silky wool contained in the capsule of Eriodendron anfractuosum, (Bombax pentandrum, Roxb.) and the only use to which it can be applied is for stuffing pillows.

4. A small quantity of double zinnia seed. *Presented by James Pontet, Esq.*

5. A supply of Gibali, Cuba, and Bhilsa tobacco seed, the produce of the Society's Nursery Garden. *For distribution.*

6. A very large and well-formed fig, the produce of his garden in Calcutta. *Presented by H. Piddington, Esq.*

The following communication accompanied the above specimen :—

"I beg to send herewith a fine fig, weighing 2 oz. (Troy) and of 6½ inches in circumforenco. A sizo and weight I think equal to good hot-house figs in England : if dried and flattened, this one would probably equal in sizo the largest Turkoy fig.

"In spite of this severe season, I have had about three dozcn of very fine-flavored figs from a very young tree, by the simplo precaution of shading the fruit by a linen or paper bag. My tree is from Chandernagore, and I shall note for those who desire to cultivate this dclicious fruit, that the productive trees arc those with somewhat narrow, dark-grecn, and deeply-lobed leaves.* The varicty with broad, light-green, and but faintly-lobed loaves (which by the way seems to be the only one in tho Botanic Garden) never that I have yet scen, ripons its fruit, though it produces plenty."

7. A few fine-tasted mangoes, the produce of his garden at Howrah. *Presented by P. Homfray, Esq.*

Mr. Homfray mentions, that this fruit is the produce of a tree raised from the stone of a mangoe tree imported somo years ago from Java, an account of which hc communicated last year to the Society. (Seo Journal of the Society, vol. iv. page 89.)

Tribute of respect to the Memory of the late C. K. Robison, Esq.

Tho Secretary stated that, before commencing the ordinary business of the meeting, ho begged to draw the attention of the members to the loss the Society had lately sustained in the sudden death of one of its Vice-Presidents, —a gentleman who had been connected with the Institution for the long period of 23 years, during five of which he had held the post of Honorary Secretary, and nine years that of a Vice-President. The records of the Society would prove the interest which the late Mr. Robison had taken in its affairs at an early period of its history, and his continued services during subsequent years were too well-known to most of the members present to need any detailed

* Which (leaves) also have a very strong smell of the fruit ! I send one with the fig.

account at his hands. But as he conceived the Society should not be satisfied with a mere verbal expression from individuals, but that an expression of regret for the loss it had sustained should be placed on record, he would beg to move the following resolution :—

"That this Society, on holding its first meeting after the lamented death of C. K. Robison, Esq., is desirous to place on record its sense of his valuable services during a period of 23 years, as Member, Honorary Secretary and Vice-President, and as Architect of the building occupied by the Society ; and that a copy of this resolution, with a letter expressive of the deep regret of the Society at his death, be addressed to his family."

The resolution was seconded by Major Sage, and carried unanimously.

Election of a Vice-President.

The Secretary next intimated, that as the number of office bearers was limited, it would perhaps be considered desirable to fill up at once the vacancy caused by the death of Mr. Robison, instead of deferring such appointment till the next anniversary meeting in January ;—whereupon, after a few preliminary observations, it was proposed by the Chairman, and agreed to unanimously, that Dr. Charles Huffnagle be elected a Vice-President of the Society, in the room of the late C. K. Robison, Esq.

NOTICE OF MOTION.

Proposal of a Gold Medal to Mr. Teil, for testing the value of the American Sumac as a tanning plant.

The proposition of Dr. Wallich, which was read at the last meeting, and deferred for consideration to the present, suggesting that some mark of distinction be accorded to Mr. Teil, of Kidderpore, for his "most disinterested and valuable services," in the matter of the American Sumac or Dividivi," was the subject which was next brought forward ; when, after some little discussion, the following notice of motion for the next meeting was given by Capt. Wm. Munro, and seconded by J. W. Laidlay, Esq. :—

"That the gold medal of the Society be awarded to Mr. J. Teil, for the disinterested and useful service he has rendered, in so zealously prosecuting certain experiments on the tanning properties of the American Sumac, the produce of the H. C. Botanic Garden, as detailed in the correspondence and shown by the specimens which have been laid before the Society by Dr. Wallich, during the last twelve months."

Exhibition of Flowers.

A list of prizes, amounting to Rs. 129, which were awarded at the second quarterly show of flowers, held on the 15th April, was submitted. From the remarks appended to this list it would appear, that at this show the collec-

tion was altogether larger, and the assortment more varied than on that held on the same day of the month last year.

The collection of phloxes, pinks, (English and Indian) asters, geraniums, portulacas, saponarias, roses, petunias, and coreopsis, was tolerably good,—in the lattor was C. parkinsonia, which was stated to be a newly imported variety. There were several fine plants of manctia cordifolia and cordia sebestena, and a rather good collection of picotees, verbenas, and sweet williams ; there were also several cut specimens of passion-flower, and poinciana regia, but only one of colvillia racemosa. Of oxalis, justicias, centaureas and begonias, the collection was poor. Prizes were offered for pentstemons, wall-flowers, carnations, and oleafragrans, but they were not forthcoming, while the specimens of salvias, brugmansias, and cleredendron were not considered worthy of prizes. The amount thus retained was transferred to the "rarer exotics" noted in the list, which consists of a fuschia, a gloxinia, salpiglossis and brachycome ibiridifolia.

In the department of indigenous plants and flowers, there were nearly a dozen cut specimens of hibiscus, and seven or oight of ixoras. The show of bauhinias was excellent ; there was also a fine cut specimen of cassia nodosa. The collection of amarydyllœ was good. Instead of giving a prize for the best *collection* of orchideœ as stated in the schedule, it was awarded for the best *specimen,* namely, cypripedium venustum. An extra prizo was given for a fine plant of acanthus inisifolium. There was only ono specimen of bignonia, B. œquinoctialis, a native of the West Indies.

Capt. William Munro officiated as judge ; the prizes were distributed by the Secretary.

The best thanks of the Society were given to Capt. Munro for the trouble he so kindly took in selecting the prize specimens on this occasion.

In connection with this subject, the Secretary submitted a communication from a Member, offoring certain suggestions in regard to the management of future exhibitions, and remarked, that being on a question involving some dotail, the letter might be referred to the Garden Committee for consideration and report. Referred accordingly.

Reduction in the rates of duty proposed to be levied on Rice and on Silk Manufactures, the produce of British Possessions.

The Secretary mentioned, that since the last meeting he had been favored with the following letter from Mr. Stikeman, Secretary to the East India and China Association, communicating the pleasing intelligence of a reduction in the rates of duty proposed to be levied on certain articles, the produce of British Possessions :—

To J. HUME, ESQ., *Hony. Sec. Agri-Horticultural Society, Calcutta.*

Sir,—With respect to the Resolutions of the House of Commons, which I sent to you on the 19th February, I have the pleasure to acquaint you, that

tho Committee have succeeded in getting them altered as regard the articles "rice" and "silk goods," the duties on which are now as follow :—

		£	s.	d.
Rice...	the cwt.	0	1	0
—— of and from British Possessions	,,	0	0	6
—— rough or in the husk	the quarter	0	1	0
—— of and from British Possessions...	,,	0	0	1
Silk.				
Manufactures of Silk, and Silk mixed with any other material, not enumerated or otherwise charged with duty, for every £100 of the value...		15	0	0
—— of or* from British Possessions...		5	0	0

I am, &c.,

JOHN STIKEMAN.

Report on Specimens of Woods from Darjeeling and Chota Nagpore.

A report by Captain Goodwyn, on the strength, quality, &c., of certain specimens of woods from Darjeeling and Purulia, which were forwarded some months ago by Dr. Campbell and Captain Tickell, was next read.

The best thanks of the Society were voted to Captain Goodwyn for his report, which was transferred to the Committeo of Papers, copies having been already transmitted for the information of Dr. Campbell and Captain Tickell.

Beneficial Effects of Under-draining.

An interesting extract of a letter from Major Jenkins, communicating the successful culture of certain products on a piece of morass, which he has reclaimed by means of under-draining, was also read, and referred to the Committee of Papers for publication.

Application of Mowah Oil to Economical Purposes.

The Secretary next submitted a letter from Mr. C. B. Taylor, of Palamow, intimating that, as suggested in a former communication when forwarding various specimens of oil, he has fully proved the capability of converting the Mowah oil (Bassia latifolia) into candles and soap.

A letter was read from Mr. Piddington, wishing to be informed if there be any rule of the Society exempting members from subscription after a certain number of years; and requesting that if there be no such rule, the circumstance may be brought to the notice of the Meeting, as he conceives some arrangements should be made in favor of members who may have been such during a period of 15 or 20 years.

* Evidently a mistake, it should be "*and*," which I have pointed out in the proper quarter.—J. S.

The Secretary informed the meeting, that there was no such rule as that referred to by Mr. Piddington among the regulations of the Society, neither, so far as he could learn from enquiry and reference to their proceedings, was any rule of this nature in force among the literary or scientific Societies of Great Britain.

The meeting was unanimous in directing the Secretary to inform Mr. Piddington, that no rule exempting members from subscription existed in the Society, and that it did not consider it expedient to make one.

At the close of the meeting the Secretary alluded to the expediency of erecting out-offices to the Metcalfe Hall for the accommodation of a certain portion of the native establishment, and desired to give notice for the next meeting, that a sum not exceeding 250 Rs. be allowed for that purpose.

Wednesday, the 10th June, 1846.

Charles Huffnagle, Esq., Vice-President, in the chair.

The minutes of the last general meeting were read and confirmed, and the gentlemen then proposed were duly elected Members of the Society, viz :—

Messrs. William Vincent and Hugh Colquhoun.

Candidates for Election.

The names of the following gentlemen were submitted as candidates for election.

Lieut. the Hon'ble E. Hastings, Deputy Commissioner, 3rd class, Saugor and Nerbudda Territories,—proposed by Capt. Henry J. Guise ;

Capt. Hugh Robison, Brigade Major, Ellichpore Division,—proposed by Dr. W. H. Bradley ;

Capt. William O'Brien, 8th Regt. Nizam's Infantry,—proposed by Dr. Bradley ;

P. E. Wodehouse, Esq., Ceylon Civil Service,—proposed by Mr. Cecil Beadon ; and

Thomas James Atkinson, Esq., Burdwan,—proposed by Mr. Henry Cowie.

The above nominations were seconded by the Secretary.

Presentations.

1. A fine specimen of Otaheite cane grown near the sea beach in Province Wellesley, opposite Penang. *Presented by Capt. Wall, Commander H. C. Steamer 'Tenasserim.'*

2. Sample of *kuppas* or seed cotton, the produce of a variety of cross-bred plants, done at Broach, in the season 1844-45, and raised in the season 1845-46. *Presented by Dr. A. Burn, Superintendent Government Cotton Farms at Broach.*

Dr. Burn states, that the brown colored *kuppas* is supposed to be a cross between Sea-island and the brown or Nankeen cotton, the latter having acted naturally the part of a mother. This produce, Dr. Burn remarks, is remarkable for the *great strength* of the fibre, also for its length and very silky nature. The plant grows to a large bush, and is not in full bearing till the second season : it is so very hardy, Dr. Burn adds, that all the seeds now sent may be cultivated advantageously as perennials, cutting them down annually at the commencement of the rains.

3. A few bunches of grapes, of the purple and white sorts, the produce of his garden at Goosree, near Calcutta. *Presented by William Stalkart, Esq.*

Mr. Stalkart submits these specimens, in order to bring to the notice of such as take an interest in the culture of the vine, that the purple sort is a *hardy* species and an *abundant* bearer, and consequently well deserving of cultivation ; but that the white sort, though perhaps the sweeter tasted, is a very poor bearer, and gives its produce in small bunches. Mr. Stalkart states, that the grapes now submitted are the produce of cuttings from the vines that bore the fruit which was presented some years ago to the Society by Captain Milner, and of which a detailed account is published in the fifth volume of the Transactions. Mr. Stalkart adds, that his vines are planted in a different situation, though equally as well sheltered as were Capt. Milner's, namely, by walls on each side. The alley in which Capt. Milner grew his vines runs east and west, closed at the ends ; Mr. Stalkart's runs north and south, and is open at the ends.

These grapes were much admired by the Members present, particularly the purple variety, than which perhaps a better specimen has not been grown in Bengal.

4. A quantity of Cape *Dhall*, the produce of the Society's Nursery Garden.

The following is the memorandum accompanying the above seed :—

Memorandum.—In March 1845, Capt. Currie sent to the Society a small quantity of *Dhall*, the produce of a stray seed, which was, by mistake, included in a packet of flower seeds sent from the Cape. The seed was planted by Capt. Currie in October 1842, and took between 16 and 17 months in ripening its seed, by which time the tree had attained the height (unusual in the Indian dhall) of fourteen feet, with a circumference of ten inches at the root of the stem, the branches extending about five feet on each side. On counting the seed, Capt. Currie found that the tree had given an enormous produce, nearly 11,500 fold, which he states to be about twenty times more than is yielded by the Indian tree ; the latter, however, requiring only 8 or 9 months—or half the time of the Cape variety—to ripen its seed.

The seed now on the table is the produce of the Society's Garden, grown from the seed presented by Captain Currie. It was sown in May 1845. The plants came up very luxuriantly, and most of them attained the height of from nine to ten feet, (or four feet less than Capt. Currie's tree) with a circumference of stem of five to five and a half inches. These trees blossomed in January and the pods ripened in March,—being a period of rather more than ten months—or six months less than Capt. Currie's tree. The Overseer of the Nursery states, that these trees are higher, and the stem thicker than the *common* country dhall; the grain, he says, is also superior, but the produce has proved to be less, and it has taken two months longer in attaining maturity. He further remarks, that it is inferior both in size and flavor to the *Patna* dhall.

It will thus be seen, that the seed of the second generation has given a less favorable return than that of the first; and taking into consideration that it requires a longer time to ripen its seed, it is doubtful whether the cultivation of this Cape variety in India would be of advantage.

It will, however, be interesting to ascertain the difference in produce and taste between this acclimated Cape dhall and the *Patna* variety, when grown on the same spot of ground in the Nursery Garden; and this experiment will be made during the present season, and the result communicated in due course.

Award of a Gold Medal to Mr. Teil for testing the value of Indian-grown American Sumac as a tanning plant.

The motion of which notice was given at the last meeting by Capt. Wm. Munro, seconded by Mr. Laidlay, to the effect, "that the Gold Medal of the Society be awarded to Mr. J. Teil, for the disinterested and useful service he has rendered in so zealously prosecuting certain experiments on the tanning properties of the American Sumac, the produce of the H. C. Botanic Garden, as detailed in the correspondence and shewn by the specimens which have been laid before the Society by Dr. Wallich during the last twelve months,"—was duly brought forward, supported by the mover, and unanimously agreed to.

Tribute of respect to the Memory of the late C. K. Robison, Esq.

The Secretary submitted the following correspondence which had taken place in accordance with the resolution passed at the last general meeting:—

To Hugh Robison, Esq.

Dear Sir,—I am directed by the Honorable the President and Members of the Agricultural and Horticultural Society of India, to convey to you copy of a resolution which was passed at a General Meeting, held on the 13th instant; and to request that you will express to the members of your family the deep sympathy of the Society at the irreparable loss they have sustained by the sudden death of your father, the late C. K. Robison, Esq. The

Society laments him as a Member who was connected with the institution for a long period in various capacities, and one who ever took the most lively interest in its proceedings.

I am, &c.
(Signed) JAMES HUME,
Hon. Secy. A. & H. S.

23rd May, 1846.

To the Agricultural and Horticultural Society of India.

GENTLEMEN,—I have to tender you my thanks for your very kind attention, and am deeply grateful for the honor you have done my family and myself. I shall take care that the friends of my late father, Mr. C. K. Robison, are made acquainted with the honorable testimony you have borne to his worth, and I am sure they will most highly appreciate your kindness.

I am, &c.,
27th May, 1846. (Signed) HUGH ROBISON.

Nursery Garden,—Sugar Cane Plantation,—Fruit-tree Nursery, &c.

A long report from the Garden Committee of a visit to the Nursery at the end of last month was next read. The Committee state, that the cane plantation is progressing favorably, notwithstanding the late very dry weather. The China cane, in particular, is in excellent condition, thus supporting the character of that variety for hardness and ability to stand all changes of season. From a comparative trial in the culture of certain sorts of cane, the Committee are of opinion, the *trench* system is better adapted for this climate than the mode of planting in *holes,* the former assisting to keep the ground longer in a moist state round the roots of the cane; it is useful also for facilitating irrigation, and on that account is adopted in Burdwan, Beerbhoom, and other Sugar districts; while in the rainy season the trenches are converted into an admirable system of drains. The Committee likewise report favorably of the lately formed fruit-tree nursery; they intimate the completion of *pucka* walks throughout the flower garden, and state that the conservatory is also progressing and will be probably finished during the present month.

The Committee next allude to a grant of the sum of sixty rupees for deepening and improving one of the tanks, and converting the deposit into manure, and the earth from the sides for raising certain parts of the garden; they suggest also, that an additional sum of 100 rupees be voted for completing the Overseer's bungalow, the former estimate of 300 rupees having been found insufficient for that purpose.

The Committee add, in conclusion, that they have taken into consideration certain suggestions from a Member of the Society for the management of future floricultural exhibitions. They are decidedly in favor of the adoption of the first suggestion with some little modification, but are not

disposed to recommend the carrying out of the other two on the ground that the one will occupy more time at the show than can be reasonably spared, and that the other will prove a bar to the entrance of native nurserymen into the list of competitors. The first suggestion is to the effect "that all competitors be excluded from the show-rooms during the time the judges are fixing on the plants for prizes," and the modification by the Committee, that "native mallees only be admitted into the show-room during the time the judges are fixing on the plants for prizes."

The Report of the Committee, in all its parts, was confirmed.

Receipt of Flower Seeds from England.

The Secretary informed the meeting that he had just landed from the '*Tartar*' the consignment of flower seeds ordered out from Messrs. Wrench and Son, of London. It consisted of upwards of forty varieties, and would be shortly ready for distribution, due notice of the same being given by advertisement.

Communications on various subjects.

1. From C. B. Taylor, Esq. Palamow, dated May 18th,—submitting sketches of two machines which he has invented for cleaning cotton, with description of the mode of working them.

2. From the same, enclosing extracts from the "Library of Entertaining Knowledge" regarding certain modes of divesting cotton from the seed.

Referred to the Committee of Papers.

3. From Capt. G. E. Hollings, Secretary Agri-Horticultural Society of Lucknow, intimating the arrival in good condition of the plants sent by the Parent Society last cold season. Capt. Hollings also desires to express his obligations to Dr. Wallich for a valuable collection of plants from the Botanic Garden.

For the foregoing communications and presentations the best thanks of the Society were accorded.

Wednesday, the 8th July, 1846.

The Hon'ble Sir J. P. Grant, President, in the chair.

Members Elected.

The gentlemen proposed at the last meeting were duly elected Members of the Society, viz :—

Lieut. the Hon'ble. E. Hastings,—Capt. Hugh Robison,—Capt. Wm. O'Brien,—Messrs. E. P. Wodehouse, and T. J. Atkinson.

Candidates for Election.

The names of the following gentlemen were submitted as candidates for election :—

J. H. Young, Esq., Civil Service,—proposed by the Secretary, seconded by Mr. Staunton.

John Teil, Esq.,—proposed by Mr. Staunton, seconded by the Secretary.

Communications on various subjects.

The following letters and papers were submitted :—

1. From Cecil Beadon, Esq., forwarding copy of a despatch from the Hon'ble Court of Directors, together with reports on the results of the sale of Assam Teas which took place in February and March last.

2. From R. K. Pringle, Esq., Chief Secretary to the Government of Bombay, transmitting a report of the operations at Broach under the Superintendent of cotton experiments during 1844-45; also certain correspondence connected with an experimental culture of wheat at Broach.

3. From C. B. Taylor, Esq., of Palamow, forwarding, in continuation of his letter submitted at the last meeting, certain additional details with sketches of cotton-cleaning machines.

4. From the same, entering into further particulars about the manufacture of Indigo from the leaves of *Nerium tinctorium.*

5. From T. B. Mactier, Esq., Secy. Branch Agri-Horticultural Society, Cuttack, enclosing a list of prizes awarded at a flower show held on the 24th of February; also the annual account of receipts and disbursements.

6. From Major T. E. A. Napleton, Secy. Branch Agri-Horticultural Society, Bhauglepore, submitting an account of an Horti-Floricultural exhibition held at that station on the 1st of June.

Major Napleton reports, that the cereal grains forwarded to the Parent Society by the Court of Directors have failed, but that the other seeds, rape, turnip, flax, mustard, &c. have yielded excellent crops.

7. From Captain F. S. Gabb, Secy. Agri-Horticultural Society, Madras, enclosing a list of prizes which will be awarded by the Society during 1846-47 for best specimens of cotton, coffee, indigo, sugar, silk and wool.

Captain Gabb also forwards a correspondence between the Society and Dr. Wallich consequent on the departure of that gentleman from India.

All the above communications were referred to the Committee of Papers for publication in the number of the Journal now in the press.

8. From Vincent Tregear, Esq., Secretary to the Local Committee of Public Instruction, soliciting contributions for the museum lately established in the Government School at Bareilly.

The Secretary was directed to meet this request as opportunities offered.

9. From Mr. D. Landreth, Philadelphia, enclosing invoice of vegetable and flower seeds shipped per '*Arragon,*' which left Boston on the 1st May.

10. From Geo. Gardner, Esq., Superintendent Botanic Garden, Ceylon, mentioning that the seed which he sent to the Society as that of *Panicum spectabile*, proves to be the seed of the common guinea grass. (*Panicum maximum.*)

Mr. Gardner intimates his intention of sending a few bread fruit and dwarf cocoanut trees to the Society shortly.

Dr. Huffnagle presented a specimen of oats grown in the Monghyr district by Mr. Adolphus Wallace, to the extent of about two thousand maunds, all averaging in weight 40½ to 41 pounds per bushel.

For all the above communications the best thanks of the Society were accorded.

Monthly Proceedings of the Society.

(Wednesday, the 12th August, 1846.*)*

Charles Huffnagle, Esq., Vice-President, in the chair.

Members Elected.

The gentlemen proposed at the last meeting were duly elected Members of the Society, viz :—

Messrs. J. H. Young, C. S. and John Teil.

Candidates for Election.

Tho names of the following gentlemen were submittod as candidates for election :—

James Cox, Esq., Burraco Factory, Tirhoot,—proposed by Mr. D. MacLeod, seconded by tho Secretary ;

Henry Alexander, Esq., Civil Service, Howrah,—proposed by Mr. H. Torrens, seconded by the Secretary ;

William Grey, Esq., Civil Service,—proposed by the Secretary, seconded by Dr. Huffnagle ;

Gilbert Farie, Esq., firm of MacVicar, Smith and Co.,—proposed by Baboo Radamadub Banorjee, seconded by the Secretary ;

Thomas Caird, Esq., Emigration Agent,—proposed by the Secretary, seconded by Dr. Huffnagle.

Presentations to Library.

1. The Flower Garden. *Presented by R. Dodd, Esq.*

2. Journal of tho Asiatic Society of Bengal, Nos. 167 and 168. *Presented by the Society.*

3. Two brochures on East Indian kino, and on the tree yielding African olibanum, by Dr. Royle. *Presented by the Author.*

Garden and Museum.

1. A small assortment of fruit and kitchen garden seeds, consisting of plums, cherries, currants, apples, strawberries, peaches, cabbage, turnip, parsley and savoy. *Forwarded by Dr. Royle, from the India House, by the June Overland Mail.*

2. A small quantity of New Zealand flax seed *(Phormium tenax)*. *Presented by Mr. John Lawrie.*

3. A supply of hill bamboo seed. *Presented by J. Pontet, Esq.*

4. A small quantity of Rungpore tobacco seed. *Presented by H. Rehling, Esq.*

5. Specimens of two kinds ("Giring" and "Rajahsay,") of Chittagong paddy. *Presented by A. Sconce, Esq., C. S.*

The Secretary mentioned that Mr. Sconce had, at his request, most obligingly sent up five maunds of the above paddy to meet an application from Col. Low, the Resident at Penang.

6. Specimens of eight kinds of wood from the Tenassorim Coast. *Presented by E. O'Riley, Esq.*

7. Specimens of raw silk from Coonoor, in the Neilgherry Hills. *Presented by Major F. Minchin, of the Madras Army.*

Nursery Garden, Sugar Canes, Flower Show.

A report was submitted by the garden Committee.

The Committee suggest, for the reasons detailed in their report, a further grant of Rs. 300 to complete certain works now in progress at the nursery; namely, a bungalow for the overseer, a conservatory, and pucka walls throughout the flower garden. The Committee state that about twenty-five thousand canes of the Otaheite, Singapore, and China varieties, will be fit for cutting during September and October next, and recommend that they be advertised accordingly. The Committee also submit a schedule of prizes for the next flower show, and suggest that it be held on Saturday, the 22nd instant. The report of the Committee, in all its parts, was confirmed.

Communications on various subjects.

The following letters were also presented:—

1. From H. Rehling, Esq., a long and interesting communication on the cultivation and preparation of tobacco as practised in the district of Rungpore.

2. From Col. J. R. Ouseley, intimating that he has made arrangements for the despatch, for the use of the Society, of three maunds of white linseed from the Nerbudda.

Col. Ouseley has also, at the request of the Society, most obligingly arranged for the despatch from the same locality, of 50 maunds of the same seed for a Member who is desirous of trying it on a large scale in Tirhoot.

3. From Messrs. Villet and Son, enclosing invoice of an assortment of Cape vegetable seeds, amounting to Rs. 1,350.

Letters were also read from the Secretaries of the Branch Societies at Hooghly, Berhampore, and Mirzapore, applying for seeds for their respective gardens.

The Secretary mentioned that he was taking steps to meet these requisitions.

For all the above presentations and communications the best thanks of the Society were accorded.

(Wednesday, the 9th September, 1846.)

Charles Huffnagle, Esq., Vice-President, in the Chair.

Members Elected.

The gentlemen proposed at the last meeting were duly elected Members of the Society; viz :—

Messrs. James Cox, Henry Alexander, C. S., William Grey, C. S., Gilbert Farie, and Thomas Caird.

Candidates for Election.

The names of the following gentlemen were submitted as candidates for election :—

Major Isaac Handscombe, 26th Light Infantry, Bareilly,—proposed by Mr. M. S. Staunton, seconded by the Secretary;

Edgar Corrie, Esq., (Firm of Birley, Corrie and Co., Calcutta,)—proposed by Mr. C. J. Richards, seconded by Dr. Huffnagle;

Thomas Gordon, Esq., (Firm of Pelletreau and Even, Mirzapore,)—proposed by Captain Currie, seconded by the Secretary;

W. J. Lawson, Esq., Tilowlee, Chunar,—proposed by Captain Currie, seconded by the Secretary;

James Dalrymple, Esq., Shikarpore, Kishnaghur,—proposed by Mr. J. W. Laidlay, seconded by Mr. R. Watson;

J. J. Gray, Esq., Dholowry, Pubna,—proposed by Mr. Laidlay, seconded by Mr. Watson;

W. Terry, Esq., Midnapore,—proposed by Mr. Laidlay, seconded by Mr. Watson;

S. J. Auld, Esq., Gurbotah,—proposed by Mr. Laidlay, seconded by Mr. Watson.

Presentations to Library.

1.—Journal of the Royal Asiatic Society of Great Britain and Ireland, Part 2, No. 16. *Presented by the Society.*

2.—Journal of the Asiatic Society of Bengal, No. 169. *Presented by the Society.*

Garden and Museum.

1.—Sixty cuttings of the Black Hamburgh and Constantia grape vine. *Presented by Dr. Huffnagle.*

Dr. Huffnagle states, that these cuttings were sent to him from the Cape by Dr. Egerton, and received per '*Timandra*' a few weeks ago. They were packed by Mr. Joseph Upjohn at 'Rondebosch,' on the 24th June last, in a small deal box, to the number of 150, simply with a little earth; and when landed in Calcutta, were immediately planted in garden pots. Dr. Huffnagle adds that 147 of these cuttings have thrown out leaves already, and are in a most healthy condition, while the remaining three appear as if they would also vegetate.

2.—A quantity of seed of the 'Bhoot-kurree' tree, (*Acacia sirissa*) and specimen of the wood. *Presented by J. W. Payter, Esq.*

Mr. Payter mentions that a consignment of the timber of this tree, cut in the neighbourhood of his residence in Bogra, is on its way down to Messrs. Currie and Co. Mr. Payter adds that Messrs. Currie and Co. made for him last year a set of dining tables of the same wood, which are much admired.

Report of Floricultural Exhibition.

A list of prizes, which were awarded, to the extent of rupees 91, at the third quarterly flower show, held on the 29th August, was submitted. The report remarks that there was not a large display of plants and cut specimens, but the collection comprised several pretty and well-grown individuals, and may be considered an improvement on the show held in August of last year. The climbers, in particular, were very prettily grown, and there was a good display of them. There was also a fine collection of the sweet scented verbena, a good show of malpigias, and some pretty specimens of xylophyllas, jatrophas, solanums and manettias. In addition to the varieties at the last show in August, were specimens of clematis, rondeletia, hedichium, lycium, veronica, and gyanarea. The show of passion-flowers was very poor, consisting merely of two or three plants and a few cut specimens. Prizes were offered for lophospermum and brugmansia, but there was not a single plant of either.

The ixoras and balsams took the lead in the indigenous department,—the display of both was very good. The clitorias also were very pretty, some of the flowers being almost double; and the same remark is applicable to some of the hibiscus tribe.

Capt. Munro and Mr. Dodd selected the prize specimens; Mr. Henry Torrens distributed the amount awarded.

The Eri worm;—the more profitable application of its silk.

Read the following letter from Major Jenkins, on the subject of turning the silk of the Eri worm to a more profitable account than that to which it is now employed:—

To the Secretary of the Agricultural Society.

MY DEAR SIR,—Adverting to the abortive attempts made to wind the silk of the Eri cacoons, I beg to call to notice Dr. Ure's article in his history of floss silk, from which it appears the floss silk of the mulberry worm is spun into thread both in England and France; so I presume the floss silk of the Eri worm could also be readily spun, with the same machinery, and this would seem to be all that was required. The Eri cacoons are readily picked to a floss, and the article thus produced, seems beautiful.

Dr. Ure in his philosophy of manufactures (2d edit.) page 3, says, "Even one kind of silk which occurs in entangled tufts, called floss, is spun like cotton, by the simultaneous action of stretching and twisting."

If you can procure any information where in England floss silk is thus spun into thread, I should be obliged, as I would like to send some of the Eri floss for trial to the owners of the machinery.

Gowhatti: I am, &c.
11*th February,* 1846. (Signed) FRANCIS JENKINS.

The Secretary intimated that not being able to afford Major Jeukins the required information, he had suggested to him the despatch of a quantity of the cacoons. This had been lately received, and a portion of it transmitted to Mr. Stikeman, with a request that he would transfer it to some of the owners of silk machinery in the manufacturing towns, in order to ascertain if the floss can be turned to account in the manuer suggested by Major Jenkins. A momorandum, regarding the abortive attempts hitherto made to unreel the silk of this worm, and the endeavors which the Society, in conjunction with Major Jenkins, had made to advance the discovery of an efficient method of bringing it into use as an article of commercial value, had also been forwarded to Mr. Stikeman.

Communications on various subjects.

The following letters and papers were also submitted:—

1. From J. Thornton, Esq., Secretary to the Government of the N. W. Provinces, forwarding copy of a Summary of Major Cautley's project for irrigating the Doab from the Ganges. Referred to the Committee of Papers.

2. From J. Stikeman, Esq., forwarding reports by certain London brokers on a sample of coffee, the produce of Col. Ouseley's plantation at Burkaghur, Chota Nagpore.

3. From R. Lowther, Esq., Allahabad, submitting specimen leaves of *Aristolochia Indica,* and stating that he has found it to be a complete specific against the poison of snakes.

4. From C. Beadon, Esq., Under-Secretary Government of Bengal, forwarding a communication from the Commissioner of Mysore, and requesting the assistance of the Society to meet the request therein preferred for sissoo seed and China cane cuttings.

The Secretary informed the meeting that the Society had no sissoo seed in store, but he had taken measures to meet the request for cane cuttings, and had despatched a large quantity, packed in several ways, by the steamer '*Bentinck.*'

5. From Capt. G. E. Hollings, Secretary of the Agri-Horticultural Society, Lucknow, giving a short account of certain Horticultural experiments, and promising to give them more in detail shortly. Capt. Hollings adds :—

"I shall in future adopt the plan proposed by Mr. Ross in his paper published in part 1, of Vol. V. of the Journal, as my own experience, such as it is, induces me to agree in all his opinions. I have had his paper translated into Ordoo for the benefit of my mallees, and will send you a copy for such consideration as the Society may consider it merits."

6. From C. Beadon, Esq., Under-Secretary Government of Bengal, conveying a request for silk-worm eggs from the Government of Bombay, and asking the Society to meet it.

The Secretary mentioned that he had taken steps to meet this requisition.

For all the above communications and presentations the best thanks of the Society were accorded.

(Wednesday, the 14*th October,* 1846.*)*

Charles Huffnagle, Esq., Vice-President, in the chair.

Members Elected.

The minutes of the last meeting were read and confirmed; and the gentlemen then proposed, were duly elected Members of the Society; viz :—

Major Isaac Handscombe, Messrs Edgar Corrie, Thomas Gordon, W. J. Lawson, James Dalrymple, J. J. Gray, W. Terry, and S. J. Auld.

Candidates for Election.

The names of the following gentlemen were submitted as candidates for election at the next meeting :—

Octavius Warre Malet, Esq., Civil Service,—proposed by Mr. H. T. Raikes, seconded by the Secretary;

W. H. Abbott, Esq., Junior Solicitor, Supreme Court,—proposed by Mr. M. S. Staunton, seconded by the Secretary ;

Robert Kerr Dick, Esq., Civil Service, Bijnore,—proposed by Mr. R. Torrens, seconded by Mr. Welby Jackson ;

R. Muirheid Reddie, Esq., (firm of Boyd, Beeby and Co.,)—proposed by Mr. Lewis Balfour, seconded by Mr. John Hamilton ;

J. Newmarch, Esq.,—proposed by the Secretary, seconded by Dr. Huffnagle.

Presentations to Library.

1. Calcutta Journal Natural History, No. 26. *Presented by Dr. McClelland.*

2. Journal of the Asiatic Society of Bengal, No. 170. *Presented by the Society.*

3. Report on the Settlement of Zillah Humeerpore. *Presented by the Government of the N. W. Provinces.*

Presentations to Museum and Garden.

1. Specimen of tea grown and manufactured by a Chinaman at Jeypore, Upper Assam. *Presented by Dr. McClelland on behalf of Major Jenkins.*

2. Two model kodalies, which he conceives to be an improvement on those in common use. *Presented by Mr. Edward Black.*

It was directed that these kodalies be placed in the model room ; and that Mr. Black's communication, explanatory of his improvement, &c. be referred to the Committee of Papers.

3. A few roots of a description of sweet potatoe, grown in his garden at Burkaghur, from seed procured from Sumbulpore. *Presented by Capt. R. Ouseley.*

Capt. Ouseley states that in Sumbulpore these roots grow to the size of the smaller sample he has sent ; the larger roots Capt. Ouseley has allowed to remain in the ground for a second year. He adds, " we have tried them, and in flavor they resemble the common English potatoe of the best kind. I do not know whether they will be considered worthy of notice, but as they have astonished all of us, *including the Natives,* I am in hopes they may be esteemed curious by you. If I remember rightly, Col. Ouseley sent you some sorts of the white sweet potatoe a year ago."

In reference to the concluding part of Capt. Ouseley's note, the Secretary mentioned that the roots presented by Col. Ouseley were planted out, on receipt, in the Society's nursery garden, where they are now in a flourishing condition, having propagated considerably.

4. A few young plants of the Nepaul red cane and of the Tirhoot boolee cane. *Presented by T. Kelly, Esq.*

Horticultural Exhibition.

A memorandum from the fruit and kitchen garden Committee, regarding the next show of vegetables and fruits, was submitted. The Committee

propose that the show be held on Monday, the 9th November, and give a schedule of prizes to be awarded on that occasion. The report was agreed to.

Unsuccessful attempt towards the introduction of Carolina Paddy in the Province of Arracan.

The following letter from Mr. Under-Secretary Beadon, together with copy of a report from the Commissioner of Arracan enclosed therein, regarding the unfortunate failure of the large supply of Carolina paddy forwarded by the Government of Bengal, in the early part of the year, for trial in that Province, were next read :—

From the Under-Secretary to the Govt. of Bengal, to the Honorary Secretary Agricultural and Horticultural Society.

Revenue. SIR,—I am directed by the Hon'ble the Deputy Governor of Bengal, to forward the accompanying copy of a letter from the Commissioner of Arrakan, No. 105, dated the 19th ultimo, and to request that you will, with the permission of the Society, furnish for His Honor's information, the result of the sowing of that portion of the Carolina seed paddy, which was made over to the Society for distribution on the 18th March last.

2. To enable the Commissioner of Arrakan to continue his endeavors to improve the rice cultivation of the Province, the Deputy Governor desires me to request, that the Society will, at the proper season of the year, procure a small quantity of the best kinds of Patna and Bengal seed paddy (about 50 maunds of each) for shipment to Akyab.

3. His Honor would also be glad to learn whether any Carolina seed paddy is now to be met with in the Calcutta market, or likely to be so before next sowing season.

I have, &c.

Fort William : C. BEADON,

7th October, 1846. *Under-Secy. to the Govt. of Bengal.*

The Secretary stated, in reference to the information asked for in the first paragraph of Mr. Beadon's letter, that he had distributed the small supply of paddy presented by Government (about six maunds) to fifty individuals, and that all the reports as yet received were (with one exception) of an unfavorable character. That exception was from a Soondorbund grantee, one of whose ryotts, by adopting a different mode to that pursued by others, had contrived to make the grain germinate. He had not yet received the promised account of the plan adopted on this occasion, but hoped to communicate it at the next meeting, together with such additional reports as might be forwarded to him by that period.

The Secretary was directed to use his best endeavors to meet the request conveyed in the second paragraph of Mr. Beadon's communication.

Sir Edward Ryan's Testimonial.

The Secretary intimated that he had received from Mr. Piddington, a letter to his address from Sir Edward Ryan, announcing the despatch of the picture which was voted to him by the Society in 1841. The following is an extract of the letter, which is dated 11th August :—

"At last Mr. Say has completed his picture for the Agricultural Society, and I hope it will be approved. It has been despatched by the Ship *Monarch*, Captain Walker, which sailed about the 27th of last month, and enclosed is the bill of lading.—The account is as follows : I received £469-9-11.

Mr. Say for picture, ...	210	0	0
Packing cases,	27	17	0
Frame,	36	15	0
Freight, Insurance,	8	5	6
	£282	17	6

leaving a balance of £186-12-5, for which I enclose a bill No. 410, dated 5th of August 1846, drawn by the Court of Directors on the Government of Bengal, being Rs. 1,947-5-9 payable to your order. The delay in sending out this picture, as I have already informed you, has arisen from Mr. Say's severe illness, and from no neglect on my part. I shall feel much obliged by your kindly acknowledging the receipt of this letter and its enclosure. I shall also be glad to learn of the safe arrival of the picture, and whether it is approved of by those for whom it is designed."

On the perusal of the above letter, Dr. Mouat gave the following notice of motion for the next general meeting :—

Notice of Motion.

"That the surplus balance from the purchase of Sir E. Ryan's picture be added to that which remained from the other subscription, to found the Ryan scholarship in the Hindoo College."

The motion was seconded by Baboo Hurreemohun Sen.

Report on Raw Silk from the Neilgherries.

A report from the Chamber of Commerce on the specimens of raw silk, produced at Coonoor in the Neilgherry hills, which were presented by Major Minchin at the August meeting of the Society, was next read and referred to the Committee of Papers for insertion in the Journal. The Secretary intimated that the report had reached him too late for presentation with that rendered by the Society's Committee, but he had lost no time in sending a copy of it for Major Minchin's information.

Tea from Jeypore, in Upper Assam.

A communication from Dr. McClelland, forwarding the specimen of tea alluded to among the presentations, was next read. Dr. McClelland observes

that it is "the only tea he has seen of this country that might bo drank for China tea without discovering any peculiarity of flavor." Dr. McClelland likewise forwards an interesting letter from Captain Hannay, to the address of Major Jenkins, regarding this tea.—[Sec Correspondence, page 132.]

Loss of the Society's consignment of American Vegetable and Flower Seeds.

The Secretary announced to the meoting the unfortunate loss, by the wreck of the *Arragon* from Boston, of the largo consignment of vegetable and flower seeds, ordered last year by the Society to the amount of 1,700 Rupees. The Society, he was happy to add, had not sustainod any pecuniary loss, the consignment having, according to directions previously given, been fully insured by the shippers.

The New Sugar-Bill in its relation to Colonial producers.

The following communication from Mr. Haworth, calling the attention of the Society to the "unfavorable position which the late alteration in the Sugar Duties has placed all engaged in manufacturing sugar in India," and suggesting that the subject be taken into consideration by the Society, was next read :—

To James Hume, Esq., *Honorary Secretary to the Agricultural Society.*

Dear Sir,—I beg to bring to the notice of the Society, "the unjust position, in which the Indian, as well as all colonial sugar producers are placed by a clause in the new Sugar Bill," and I would submit that it is the duty of the Society to look well into tho subject, and to adopt such measures as may be deemed necessary to endeavor to obtain the withdrawal of the objectionable clauses, and which clauses Lord John Russell has stated in his place in Parliament he had no objections to reconsider on the subject being brought forward another session—therefore if any relief is to be obtained we are as good as told we can now ask for it.

When the last petition to parliament on the subject of the sugar duties was sent from the Agricultural Society, we asked for protection, so far as the exclusion of slave-grown sugar was concerned, and also that the differential duties on *quality* might bo abolished : it ended in slave-grown sugar being excluded except on paying a very high duty—but the differential duties were continued. Since that period a gradual change has taken place in public opinion, which appears to have taken a more liberal course, and now "Freo Trade and no monopolies is the order of the day," and I believe tho India sugar interest requires nothing more than to be *free* of monopoly—in fact a fair field and no favor, to enable the sugar producor to competo with either foreign free labor or slave-using countries—in fact the colonies have now, or will in the course of a year or two, to place themselves in a position to cope with all foreign sugar-growing states, and it will be well

if they are all successful in attaining this position, but at the very outset, the new Sugar Bill has placed in their way a great obstacle, in the form of a most unjust and uncalled for *Monopoly*, and for what reason? *To protect the British refiner.* This is done in the same breath that professes to be anxious to do away with all protection.—Now why should the home refiner be protected more than the Colonial or planter? or why should his monopoly be continued whilst his neighbours, the cotton and other manufacturers, as well as the home and Colonial agriculturist are now and for ever deprived of their protection? I have not found a good reason, nor have I heard one advanced; —in fact the home refiner is now no longer required, and all that they can do, can as well be performed by the colonial sugar manufacturer at a rate which would enable them to give a considerable advantage to the consumer. But what is the consequence of the colonial sugar maker endeavoring to compete with the comfortably protected home refiner; why, he is fined 2*s.*: 4*d.* per cwt. if he dare presume to send home an article in the least degree better than common muscavado sugar; if he carries his daring a trifle further and endeavors to intrude an article equal to English crushed lump sugar, he is fined 4*s.*: 8*d.* per cwt., and if he would treat the consumer with a cheap Indian loaf sugar he must suffer a fine of 6*s.* per cwt. Now it is quite easy for the Colonial, but more especially the East Indian sugar maker, to produce all the before mentioned qualities, at a very moderate advance upon the cost of the article liable only to the 14*s.* duty, as it can be done all under one operation, but the difference in price at home between the low kind and the fine will not admit of the importer paying the high duty and still have a margin left for profit and which bears out the intention of the law and proves it has been well framed to give the home refiner a monopoly. But why should the consumer (to whom they profess a desire to give cheap sugar) have to pay the price of this bounty to keep up a system and a class no longer necessary, or to pay for that being done at twice, which could as well be done at one operation in the colonies, the saving of freight, duty, and charges on that portion taken out by refining? Here are three samples of sugar;—No. 1 is liable to be charged 14*s* duty; No. 2, 16*s.*: 4*d.* and No. 3, 18*s.*: 8*d.*; these are all made in one loaf or cone of sugar, and as the latter will not sell at a price to afford the high duty, the manufacturer is obliged to stop short at No. 1, whilst at a very trifling extra expense he could as well have made the finer quality. In this country it tells both against the manufacturer and the grower of the cane, and it is on this latter score, that I consider the Agricultural Society will not only be performing one of its duties by taking the matter up and giving it all its influence,— in which it is likely to be joined or supported by other bodies, and private opinions on the subject,—with a view to obtain the objectionable clause to be rescinded; so that good sugar, like good silk, indigo, tea, coffee, &c. &c. may be admitted at one duty with the lower qualities, and thus instead of fining a party for using the best of his means and ability to produce the finest article,

his raw material will admit, let him have full scope to make tho most of his talents and to use his most expensive block to the greatest advantage.

As yet the growing of cane and date for sugar is mostly in the hands of natives who prepare it by rude moans into *khaur*, an articlo that both the home and Indian refiner can uso, but it is now almost certain this articlo can no longer be sent to England with a chance of compoting with foreign raw sugars, which are better adapted for refining purposes;—consequently the ryot must now depend upon Indian marts, or produce less of the article; but with a fair field there is no doubt English capital will be invested, if it is not already sunk, to an extent which will take off all surplus quantity to be refined beforo leaving the country; saving tho freight, duty, and charges on near 50 per cent. of the raw article which is left in the form of molasses and dirt.

In fact, unless this boon be granted, no party can afford to lay out the required capital for producing sugar, until they are left unshacklod to make the most of their expensive machinery. I would not ask for any protection, nor do I believe India requires any thing but a "fair field and no favor" to enablo us to compete with all our foreign neighbors, and I hope the Society will take the matter up in good earnest and endeavor to obtain this clear field for the growth and manufacture of such an important article, and in the long run the consumer will benefit fully more than the manufacturer, should the rescinding of this monopoly bo obtained.

Cossipore: I remain, &c.
13th October, 1846. W. Haworth.

At the close of the perusal of the above letter, and after some discussion, it was agreed to refer tho matter for the consideration and report of a *special* committee composed of the following members:—Messrs. Laidlay, Willis, Kettlewell, Haworth and Griffiths.

Communications on various subjects.

The following lettors and papers were also submitted:—

1. From E. D. Wilkins, Esq., Magistrate of Noakolly, intimating that he roceives daily one report at least of a death by a snake bite, and requesting to be furnished with cuttings or seeds of Aristolochia Indica *(Isurmool)* as an antidote against them.

The Secretary montioned that he had applied to Dr. McClelland for soeds, which he would forward, immediately on receipt, to Mr. Wilkins.

2. From Major Napleton, Honorary Secretary Branch Agricultural and Horticultural Society, Banglepore, returning thanks for a supply of seed lately sent for the Branch garden.

3. From Major Jenkins, suggesting the publication of the drawing of the Baroach *Churka* in tho Society's Journal.

4. From John Teil, Esq., furnishing certain information regarding the culture of American Shumac, in reply to several queries of Major Macfarquhar at Tavoy.

5. From a Member recommending the general application of Charcoal in Horticultural operations, and giving extracts from Liebig on the subject.

The three last letters were referred to the Committee of Papers ; and for all the foregoing communications and presentations the thanks of the Society were accorded.

(Wednesday, the 11th November, 1846.)

Charles Huffnagle Esq., Vice-President, in the Chair.

The minutes of the last meeting were read and confirmed.

Members Elected.

The gentlemen proposed at the last meeting were also duly elected Members of the Society, viz :—

Messrs. O. W. Malet, C. S. ; W. H. Abbott, Junior ; R. K. Dick, C. S. ; R. M. Reddie, and J. Newmarch.

Candidates for Election.

The names of the following gentlemen were submitted as candidates for election at the next meeting :—

George Falkner, Esq., Tirhoot,—proposed by Mr. Hugh Colquhoun, seconded by the Secretary ;

Capt. Johnstone, Commandant, 1st Regt. Nizam's Infantry,—proposed by Dr. W. H. Bradley, seconded by the Secretary ;

Capt. W. B. Wemyss, 9th Cavalry, Brigade Major, Meerut,—proposed by Mr. J. O. B. Saunders, seconded by the Secretary ;

Capt. C. Y. Bazett, 9th Cavalry, Cawnpore,—proposed by Mr. Saunders, seconded by the Secretary ;

R. R. Carew, Esq., Tremohny, Jessore,—proposed by Mr. S. P. Griffiths, seconded by Mr. R. Dodd ;

P. Johnson, Esq., Calcutta,—proposed by Dr. Huffnagle, seconded by Mr. S. P. Griffiths ;

A. T. Dick, Esq., Civil Service, Rungpore,—proposed by Dr. Huffnagle, seconded by Mr. Adam F. Smith ;

Capt. Rutherford, Collector of Canal Dues,—proposed by Mr. Henry Torrens, seconded by the Secretary.

Presentations to Garden and Museum.

1. Six Sylhet orange trees. *Presented by R. W. G. Frith, Esq.*

2. Specimen of coffee, the produce of a garden at Seebsagur, Upper Assam. *Presented by Major Jenkins.*

Mr. James Cowell, to whom this sample was referred, describes it as altogether wanting the characteristics of good coffee, being deficient in size, fragrance and color: and he conceives it to be the offspring of a bad stock, probably from Java or Sumatra berry, as it bears no resemblance to the Mocha bean.

3. A small supply of China tea seed from the Kemaon Nurseries. *Presented by Dr. Jameson, Superintendent Botanic Gardens, N. W. Provinces.*

4. Sample of wool, the first cross between the Cape Merino and Jessulmere sheep. *Presented by H. Hamilton Bell, Esq., of Agra.*

The sample was well thought of by the meeting, and the Secretary was requested to obtain a definite opinion on it.

Nursery Garden.

A report from the Garden Committee was read. The Committee recommend a further and final grant of two hundred rupees to the Overseer to complete his bungalow and certain other works. They suggest a few improvements to the flower garden in the shape of additional walks. They allude to the distribution of 18,000 canes during October, state that about 15,000 more are now available, and mention that they have directed several other parts of the garden to be prepared for new plots, to allow certain portions of the present plantations to lie fallow after this season's cuttings.

The Committee, in conclusion, recommend that in consequence of the unusually heavy falls of rain lately experienced, the vegetable show be postponed to the end of the month.

The report of the Committee, in all its details, was confirmed.

Provision for Garden and Flower Seeds, for 1847.

The Secretary submitted a memorandum on the subject of a provision of garden and flower seeds for next year, in which it is suggested that a larger supply be procured to compensate for the disappointment experienced this season by the loss of the consignment from the United States, per *Arragon;* and further, that another trial be given to Mr. Carter of London, he having engaged to forfeit the cost if the seeds do not germinate, provided the mode of packing and transmitting be left entirely to him.

Resolved.—That the sum of Rs. 4,000 be reserved to meet the cost of next year's consignments; and that the Garden Committee do take the suggestions

contained in the above memorandum into consideration, arrange all the details, and report the result to the next general meeting.

Proposed second attempt for the introduction of Carolina Paddy into Arracan.

The following letter from Mr. Under-Secretary Beadon, communicating the wish of the Deputy Governor to attempt a second time the introduction of Carolina paddy into Arracan, and requesting the assistance of the Society towards effecting that object, was next read :—

To JAMES HUME, ESQ., *Honorary Secretary Agricultural Society.*

Revenue. SIR,—I am directed to acknowledge the receipt of your letter, dated the 16th instant, and to express the thanks of Government for the readiness the Society continue to shew in assisting to procure a superior description of rice for introduction into Arrakan.

2. The Deputy Governor is desirous of again trying the experiment of procuring Carolina paddy from America, and desires me to request that the Society will undertake to procure the same quantity as before, giving particular instructions to the parties whom they may employ for the purpose, to wait until the harvest, and then to ship without delay the required quantity of the most approved description of Carolina seed paddy in a perfectly fresh condition.

3. His Honor trusts that the Society will be careful to ensure the preservation of the seed obtained from the few plants which are said to have germinated under the care of a ryot in the Sunderbunds, with a view to the further propagation of the variety next season.

I have, &c.

Fort William: CECIL BEADON,
The 28th October, 1846. *Under-Secy. to the Govt. of Bengal.*

The Secretary stated that he had addressed Messrs. Smith, Huffnagle and Co., through whom the previous consignment was procured, on the subject of the above letter, and had now the pleasure to submit a reply from that firm in which they express their readiness to execute this second order, but ask for positive instructions regarding the mode of packing the paddy, and for any other information which may appear desirable to ensure its receipt in good condition.

It was agreed to refer the matter for the consideration of the grain committee.

In reference to the concluding paragraph of the above letter, the Secretary observed that he had received a communication from Mr. Harris, intimating that the verbal report which he had before given on the statement of some of

his ryots, and the substance of which was communicated at the last meeting, had proved on further personal enquiry, to be altogether incorrect, *every* attempt to grow the seed having proved a failure. Mr. Harris encloses a letter from the Superintendent of his grants, who thus writes :—"I feel confident that this failure cannot be attributed to want of care on the part of the ryots, as the seed was tried in various ways, that is to say, in low land, high or early paddy lands, and in other lands not comparatively high or low: others tried it by soaking it in water, as they commonly do with their own seed, three or four days previous to sowing it in the ground, which always, if the grain is healthy, begins to sprout by that time in water ; the Carolina seed, on the contrary, began to throw off the husk when a day or two in the water."

Mr. Haworth mentioned that, having seen the account in the proceedings of the last meeting of the supposed success of the Soondorbund ryot above referred to, he had made another trial with a remnant of the supply of seed which he had received from the Society, by soaking it in water for twenty-four hours, which had the effect of making the seed sprout, but the young plants died away very shortly after they had been put in the ground. An attempt to quicken the germinating power of the seed by steeping it in a weak solution of sulphate of ammonia, had proved altogether unsuccessful.

The Secretary remarked that, in addition to the above quoted letter of Mr. Harris, he had received several communications from other members of the Society which, with one exception, simply state that the seed had entirely failed to vegetate. The exception to which he referred was a letter from Mr. Payter of Bograh, to which, as containing a few interesting facts, he begged to call the attention of the meeting :—

To James Hume, Esq., *Honorary Secretary to the Agricultural Society.*

Sir,—In reply to your letter of the 16th instant, I beg to state, that the first package of Carolina rice seed received by me from the Society in March last, was sown with great care and in due season, (about the 10th June) in a bed intended for transplanting, but I regret to say not a grain germinated ; the same result occurred with the second package sown about fifteen days after.

I now beg to draw your attention to the fact, that the Carolina rice according to the musters sent to the Society in July-August 1845, is not a rice for transplanting, that is to say, it belongs to the *Ouse* and not to the *Amun* crops, and consequently ought to be sown broad cast in April and May, and should be fit to cut in July-August.

The proof I adduce of the fact is, that some time in August last year I received from our Sub-Secretary a small parcel, about an ounce, of rice seed labelled, and said to be by him Carolina, at the same period I also received a like quantum of Nurbudda rice : these parcels I carefully preserved, and on

the 1st June sowed them in separate patches in my garden—when sufficiently high, the plants (2-4ths being germinated) were transplanted, and continually well supplied with water undor the supposition of its being an Aumun crop—you may judge of my surprise to find the crop ripo about the middle of August; it was gathered and is now carefully kept for a new trial as *Ouse* next year. The Nurbudda specimen had likewise the same result.

It may be worth while to keep in view the fact, that the seed well taken care of has germinated after a lapse of nearly two years from the period when it was reaped.

Bograh: I am, &c.
28th October, 1846. J. W. Payter.

Sir Edward Ryan's Testimonial.

The Secretary drew the attention of the meeting to the picture of Sir Edward Ryan which had just been landed from the *Monarch*, and, in connection thorewith, begged to state that Dr. Mouat had withdrawn the motion, of which he had given notice at the last meeting, in reference to the surplus balance of this testimonial. The Secretary also laid on tho table a paper he had circulated among the resident members, subscribers to the testimonial, shewing that the majority had transferred their respective proportions of such surplus to the funds of the Society. He further remarked that communications to the same effect had been already received from about three-fourths of the mofussil contributors.

Communications on various subjects.

The following papers and communications were also submitted:—

1. From A. Campbell, Esq., Supt. of Darjeeling, submitting copies of a correspondence regarding the quality of the Walnut-tree of Darjeeling, especially in referenco to its suitableness for gun stocks.

2. From Col. J. R. Ouseley, furnishing replies to certain queries of a Ceylon Planter regarding the capabilities of Chota Nagpore for the culture of coffee.

Referring to the satisfactory progress of his own plantation of coffee as also that of the Government experimental garden, Col. Ouseley adds: "I must also mention that I have a good plantation of tea from China stock supplied by Dr. Wallich three years ago, 200 or 300 large plants, which having produced seed in abundance, have enabled me to extend the cultivation this year. I expect several thousand young plants will be planted out. The old plants are from five to seven feet in height, aro covered with blossom now—many also are in seed. I wish I knew how to set about making tea."

3. From T. J. Finnie, Esq., Palamcotta, forwarding soveral recipes for preventing the ravages of Weevil in grain.

4. From G. G. Mercer, Esq., Eta, offering a few remarks on the culture of indigo, cotton and sugar.

5. From Dr. Jameson, Supt. H. C. Botanic Gardens, N. W. P., reporting the progress of tea culture in Kemaon and the Deyrah valley.

The above communications were referred to the Committee of Papers.

6. From John Allan, Esq., giving the following report on the sample of tea submitted at the last meeting, as grown and manufactured from China plants by a Chinaman at Jeypore, in Upper Assam :—

"I have given a fair trial to the Jeypore tea. It appears to me to be an excellent strong flavoured tea, resembling a superior kind of Congo,—and if I had not known it to be from Upper Assam, I should have taken it for genuine tea from China. I think it is a kind of tea that would sell well in the English market, as they like tea of a strong flavor. I found three tea spoonsfull made stronger tea than is generally used."

7. From H. Hamilton Bell, Esq., on the subject of an improved mode of divesting cotton from its seed.

Mr. Bell remarks,—"I observe you have paid some attention to an improved churka for freeing cotton from its seed, which has been invented by Mr. Burn, and that you had applied to Government for its transmission from Bombay. If it has reached you I should be much obliged for any information as to its peculiarities. From Dr. Burn of Broach, I understand that the Native churka in use there will clean more than six times the quantity our imperfect churkas do, and if his brother's invention has improved on them, it is deserving of great attention, and in fact is of the highest importance in any attempt to render our Indian cotton suitable for the English market. To me, at the present moment, it is of much interest, as the Government has readily and liberally engaged in an experiment I suggested, and from which I am disposed to hope important results, if we can, in the first instance, send cotton not absolutely unsuitable for the English manufactures. I think this is not impracticable at a remunerating price, and I am persuaded that, this attained, the rest will follow."

The Secretary informed the meeting that he had also lately had enquiries of a similar nature to the above from Major Jenkins,—whose desire to aid in the introduction of a more perfect cotton-cleaning machine than we at present possess was shown by the amount which he had so liberally placed at the disposal of the Society to be awarded to any person who should invent a truly serviceable machine of this nature,—but he regretted to say that he was not in a position at present to offer any satisfactory information on the subject. When the question was brought to the notice of the Society at the general meeting held in March, he had, in pursuance of a resolution of that meeting placed himself in communication with the Government of Bombay through the local Government, and had been informed in reply, that the former Government had been requested to send the machine in question

to the Society by the first opportunity; it had not, however, yet come to hand.

8. From T. Barlow, Esq., Mirzapore, advising the despatch of two and a half maunds of the white linseed of the Nerbudda, at the request of Col. Ouseley.

A long statement containing an abstract of various communications received from all parts of the country regarding the out-turn of the large supply of cereal grains forwarded last year by the Court of Directors, was also laid on the table, and referred to the Committee of Papers.

For all the above communications and presentations the best thanks of the Society were accorded.

[illegible] Surveyor General's Office, Calcutta; for the Month of August, 1846.

Moon's Phases.	Observed at 9 H. 50 M. Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of wet Bulb.	Wind. Direction from Sunrise to 9 h. 50 m.	Observations made at Apparent Noon. Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of wet Bulb.	Wind. Direction from 9 h. 50 m. to Noon.	Observed at 4 P. M. Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of wet Bulb.	Wind. Direction from 2 h. 40 m. to 4 p. m.	Observations made at Sunset. Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of wet Bulb.	Wind. Direction from 4 p. m. to Sunset.	Rain Gauges. Elevation. Feet. 56 Upper.	Rain Gauges. Elevation. Feet. 4 Lower.
	Inches	°	°	°		Inches	°	°	°		Inches	°	°	°		Inches	°	°	°		Inches	Inches
	29,544	83,0	84,0	80,5	S. E.	29,528	87,5	88,0	82,0	S. E. ..	29,466	88,0	87,6	81,8	S. E....	29,475	84,8	85,0	80,0	S. E. ..	..	..
	,550	89,0	88,0	81,0	S. ...	,533	89,0	87,0	80,8	E.	,478	85,0		80,	S. E....	,484	84,4	84,0	80,3	S.......	0,67	0,74
	,544	85,0	84,5	80,6	E. ..	,523	83,0	83,4	81,2	S. E...	,460	84,0		80,	E.......	,496	82,5	83,0	80,3	E.......	0,96	1,00
	,584	85,0	84,2	79,2	S. E. ..	,590	86,5	86,0	81,0	E.	,529	87,0		81,	S. E. ..	,542	83,5	84,0	79,5	S. E. ..	0,28	0,31
	,641	85,8	86,0	81,0	S. S. E.	,626	89,0	88,4	82,0	S. S. E.	,569	87,2		80,	S. S. E.	,579	83,5	83,7	79,0	S. S. E.	0,10	0,16
	,677	82,5	82,2	79.0	S. E....	,672	82,0	82,8	79,5	S.	,586	86.5		80,	S.......	,610	83.0	83.0	79,0	S.......	..	..
○	,673	85.5	86.0	81,0	S. S. E.	,657	87,1	87,0	81,8	S. S. E.	,573	88,5		82,	S. S. E.	,584	84,8	85,1	80,0	S. S. E..	0,14	0,21
	,675	83,0	84.9	81,7	S.......	,659	87.0	87,5	80.8	S.	,567	89 8		80,	S.......	,584	85,0	85,3	80,1	S.	..	..
	,669	88,0	88.0	81,0	S.......	,657	89,5	90,0	81,6	S.	,570	88,4		80,	S.......	,587	84.5	85,0	80,0	S.......	..	..
	,673	86,5	87,0	81,0	S. W...	,653	88,4	89,0	81,9	S.	,580	90,0		83,	S.......	,639	86,0	86,7	82,5	S. W...	0,07	0,14
	,689	84,4	85,0	81,0	S.......	,664	87.5	88,0	82,6	S. W...	,591	90,5		82,	S. W...	,600	85,5	85,6	81,2	S. W...	..	..
	,607	89,0	89,7	83,0	W.	,586	90,5	90,5	82,2	N. W...	,513	89,1		81,	N. W.	,512	86.5	87,3	82,8	N. W..	0,13	0,20
☾	,622	88.0	88,0	81,0	N. N. E	,602	90,0	89,8	81,0	N. W...	,525	92,0		81,	N. N. E.	,549	88,0	88,0	82,0	N. N. E.	0,08	0,15
	,635	83,0	84,0	80,8	W.	,612	84,0	85,0	82,0	N. W...	,555	78,5		78,	N. W...	,564	81,0	81,8	79,0	N. W...	1,06	1,20
	,595	86.0	86,0	81,0	S. E....	,554	89,5	89,8	83,5	S. E. ..	,549	87,0		82,	E. S. E	..	..	..	..	S. E. ..	0,61	0,74
	,606	84.5	83,6	81,0	S.	,568	87,0	88,0	83,0	S.	,502	89,6		82,	S.......	,524	85,2	85,0	80,0	S.	0.05	0,10
	,548	87,5	87,8	83,0	S. S. E.	,517	88,5	87.9	83,0	S. S. W.	,441	87,0		83.	S.......	,464	85,0	85,6	82,0	S......	3,13	3,27
	,492	87.8	80.0	83.5	N. W...	,461	83,2	82,5	80,5	S. W. ..	,407	81,1		81.	N. W...	,418	81,5	82,4	81,0	N. W...	..	..
	,494	85,0	85,5	82,1	S. W.	,480	86,5	87,5	83,4	S. W...	,431	82.0		80,	S. W...	,444	82.0	83,0	81,1	S. W...	0.10	0,17
	,571	82,5	83,5	80.9	S. W.	,549	82,2	83.0	81,0	N. W...	,490	83,2		78,	S. W...	,487	82,0	82,5	80,0	W... ..	0,93	1,03
●	,597	79,4	78,5	76,0	S. E..	,572	83,0	83,5	78,0	S. E. ..	,471	86,4		81,	S. E....	,503	83.0	83,5	80,1	S. E. ..	..	..
	,615	87,0	86,0	81.0	S. E..	,583	90,0	89.8	82,2	S. E. ..	,512	86.5		80,	S.......	,520	83,1	83,7	80,2	S.W. ..	..	..
	,613	89,0	88,5	81,9	E. ..	,597	91.0	91,0	83,0	N. E. ..	,520	84,2		82.	E.......	,524	85,0	84.9	80,5	E.	0.34	0.43
	,624	85,0	85,7	80.8	S. ...	,609	87,1	88,0	83,0	S. E. ..	,520	90,0		83,	S.......	,523	86,0	86,0	81,8	S.......	0,06	0,12
	,623	87,5	86,5	81,5	S. E..	,605	88.5	89.4	84,0	S. E. ..	,508	90,3		83,	S. E. ..	,526	88,4	88,0	82,8	S. E ..	..	..
	,590	88,4	88,0	82,8	S. E..	,568	90,0	89.4	84,0	S.	,494	86,0		83.	S. E....	,518	85,0	86,0	82,0	S. E....	0,27	0,38
	,546	88,0	87,9	83,0	S. E	,549	81,8	81,0	79,8	S.......	,479	80,0		79,	S. E....	,495	80,8	81,7	80,0	S. E....	0,27	0,38
	,555	89,2	88,0	83,0	S. E.	,533	89,0	87,6	82.9	S. E. ..	,462	87,8		81,	S. E....	,486	86,0	86,0	83,0	S. E. ..	0,04	0.08
☽	,583	89,0	90,0	84,9	S. W.	,559	87,0	87.5	83,0	S. W. ..	,506	86,5		82,	S. W...	,519	84,5	85,0	81,5	S. W. ..	..	..
	,632	90,0	90,0	83.0	N. W.	,610	90,0	89,8	82,9	W.	,536	88,0		82.	N. W.	,549	87,0	86,9	82,5	N. W...	..	..
	,623	89,0	89,1	83,5	W. N	,582	92,0	92,0	81,0	W. ...	,489	91,7		81,	W.N.W.	,504	88,8	89,0	81,2	W.N.W.	2.30	2,42

The Observations during the present Month, have been made for the most part with a supply of new and first-rate instruments received into the Observatory, by orders of the Bengal Government, a brief description of the Instruments seems necessary.

Barometer by Troughton, used prior to the 1st June 1844, Observations reduced to 32° Fah. = 29,493

" by Col. Everest, used from 1st June to 31st August 1844, ... Ditto .... = 29,637

No. 59.

Monthly Proceedings of the Society.

(Wednesday, the 9th December, 1846.*)*

Baboo Ramgopaul Ghose, Vice-President, in the chair.

The minutes of the last meeting were read and confirmed.

Members Elected.

The gentlemen proposed at the last meeting, were duly elected Members of the Society, viz.—

Capt. Johnstone (Nizam's army), Capt. W. B. Wemyss, Capt. C. Y. Bazett, Capt. W. Rutherford, Messrs. Geo. Falkner, R. R. Carew, P. Johnson, and A. T. Dick, C. S.

Candidates for Election.

The names of the following gentlemen were submitted as candidates for election at the next general meeting:—

Francis Bailey, Esq., Calcutta,—Proposed by Mr. R. Dodd, seconded by Mr. S. P. Griffiths.

Robert Fergusson Ross, Esq.,—Proposed by Mr. Lewis Balfour, seconded by Mr. G. B. Robinson.

W. H. Parish, Esq., Bengal Artillery,—Proposed by Dr. Strong, seconded by the Secretary.

Presentations to Garden and Museum.

1. A supply of white linseed (2½ maunds) from the Nerbudda, and a small quantity of tea seed from his experimental plantation at Burkaghur, Chota Nagpore. *Presented by Col. J. R. Ouseley. (These seeds are for distribution.)*

2. Seeds of a few sorts of acacia, and two or three other kinds of seeds from Central Australia. *Presented by Mr. Louis Piesse.*

3. Samples of sandal wood and raspberry-jam wood from Western Australia. *Presented by Dr. Huffnagle.*

Provision for Vegetable and Flower Seeds for 1847.

The following report from the garden committee, regarding consignments of seeds for the next year, was first submitted :—

In accordance with the resolution of the last general meeting,—" that the sum of Rs. 4,000 be reserved to meet the cost of next year's consign-

ments of seeds, and that the garden committee do take the suggestions contained in the above memorandum into consideration, [alluding to a memorandum submitted at the general meeting] arrange all the details, and report the result to the next general meeting."

Your committee beg to state the mode in which they have endeavoured to meet the wish of the Society, as arranged at a sitting held on the 17th November ;—

Flower Seeds from England.—Taking into consideration the great disappointment experienced again this year in the seeds forwarded by Messrs. Wrench, of London,—which failure the committee do not attribute to any inferiority in quality, but to the unfavorable season at which they came to hand, namely, in the heart of the rains,* and to their transmission in *bulk*, which rendered exposure to a humid atmosphere necessary for the subdivision of the seeds,—the committee have determined on ordering the consignment for 1847 to be despatched by the overland conveyance to reach this in the early part of October, thereby avoiding the damp of our rainy season, and enabling the seedsman to send seeds of the *latest* gathering, that is to say, of June, July, and part of August.

Referring to the very large and varied consignment forwarded by Messrs. Wrench, and to the marked desire expressed by that firm to meet the Society's wishes, your committee would have been disposed to send the present order to them under the proposed new arrangement, but a communication has been brought to their notice which cannot be passed over. It is from Mr. Carter, of London, who, in expressing his regret at the failure of a supply of seeds sent by him to the Society in 1845, offers to forward another batch under an engagement to forfeit the cost if the seeds do not germinate, *provided the mode of packing and transmitting be left entirely to him.* This offer the committee have accepted. The mode of transmission proposed by Mr. Carter, coincides with that of the Committee, viz.—by the overland route : and without wishing in any way to interfere with his proposed arrangements as regards the packing, &c. of the seeds, they have suggested for his consideration, the sending of the supply in two cases, one-half the quantity being subdivided by him into 200 packets—according to the manner adopted with such success by the Cape and American seedsmen,—the other half being sent in bulk for subdivision on arrival. If this be carried out, the first half can be forwarded immediately on arrival to the mofussil members, and the second half can be afterwards distributed to the town members.

The committee have sent for Mr. Carter's guidance a copy of the list of seeds received from Messrs. Wrench, and have placed a similar sum at his disposal (£60) for the cost of the consignment ; the same being exclusive of charge for overland carriage, insurance and packing.

* The seeds were received in June, and were consequently of the previous year's gathering, having been despatched in February.

Vegetable and Flower Seeds from the United States.—In consequence of the Society not having had to incur any expence this year for seeds from America,—the consignment, amounting to Sp. Drs. 850, which was lost per *Arragon,* having been fully insured—the committee have appropriated Sp. Drs. 1,000 for a consignment of vegetable and flower seeds for next year, to consist of 500 packets of the former, and 400 of the latter, being the same quantity of vegetable seeds as ordered last year, and 100 packets of flower seeds in excess. The additional sum of Sp. Drs. 150 will enable the seedsman (Mr. Landreth, of Philadelphia), to increase considerably the assortment of *flower* seeds, which has not hitherto been so varied as could be desired, and to give the 100 additional packets noted above.

Vegetable Seeds from the Cape.—The consignment of vegetable seeds forwarded this year by Messrs. Villet, of the Cape, having proved good, the committee have directed that 500 packets be sent next year, instead of 400 as ordered for this year; and have allowed Rs. 1,500 for this purpose. The three indents will therefore amount as follows:—

From England, £60	Rs.	600
From America, Sp. Drs. 1,000	„	2,000
From the Cape, ...	„	1,500
Total	„	4,100

In conclusion, your committee have the pleasure to append to this report copies of the several lists transmitted, and trust that the out-turn of 1847 may prove altogether more satisfactory than that of the present year.

(Signed) RICH. DODD. G. T. FRED. SPEEDE.
J. W. LAIDLAY. WM. G. ROSE.

A minute by Mr. Speede, regarding the more extensive growth of seeds in this country for the use of the Society, was next read. Mr. Speede suggests that certain sorts of vegetables and flowers (of which he gives a list) be annually raised in the Society's garden, so as to provide a quantity of seed of the freshest description for distribution, and render the Society less dependent on other countries for yearly supplies. Mr. Speede recommends certain precautions with the view of preventing degeneration, especially the importation of fresh seed every year. Mr. Speede's memorandum was referred for the consideration of the other members of the committee.

In connection with the foregoing report, the Secretary submitted the result of three separate trials which had been given to a small batch of flower seeds that had been presented to the Society by Mr. R. Dodd. These seeds, he remarked, were sent by Messrs. Wrench as the gathering of the present year; they were despatched from England in September by the overland mail and sown in the middle of November. The three reports, which were from Mr. Speede, the Deputy Secretary and the Overseer of the Society's

garden, were all to the same effect, namely, that, with the exception of two, all the seeds, consisting of twenty sorts, had germinated freely; a few within three days, and the others in the course of a week. Mr. Speede remarks that he "can hardly speak in too high terms of these seeds,—they are fully equal in freshness and germinating power to those sent out some six years ago by Dr. Royle, if indeed they be not superior to them;" and the Deputy Secretary adds, "It must be borne in mind, that these seeds were sent by the same firm who supplied the Society this year with their annual supply; the latter, the reaping of last year, all failed; while the former, the gathering of the past autumn, have succeeded remarkably well; thus assisting to prove that the recommendation embodied in the report of the committee, if preperly carried out, is likely to prevent the failure of English seeds in future.

Carolina Paddy.

The minutes of the grain committee, regarding the best mode of packing and shipping from the United States, the supply of Carolina paddy ordered on account of the Government of Bengal for trial in Arracan, were next submitted. The Secretary stated, that he had embodied the substance of these minutes in a communication to Messrs. Smith, Huffnagle and Co., the firm to whom the order has been entrusted, and who in reply had intimated their intontion of carefully carrying out the instructions therein contained.

Exhibition of Flowers.

Another report from the garden committee, presenting a schedule of prizes, amounting to 156 Rupees, to be awarded at the fourth and last show of flowers for the current year, was also read. The committee suggest that the exhibition be held on Tuesday, the 29th instant, at 11 a. m. They further recommend that a sum not exceeding 83 rupees be sanctioned for a vinery, with the view of testing, if the plan of growing the grape on high walls, a certain distance apart, is well suited for increasing the healthiness of the vine and the size of the fruit. The report was confirmed.

Horticultural Exhibition.

A list of the prizes, amounting to 106 rupees, which were awarded at the show of vegetables and fruits, held on the 3rd December, was placed on the table. It is remarked, that considering the lateness of the season, occasioned by the unusually heavy falls of rain experienced throughout October and the early part of last month, the display of vegetables was better than could have been anticipated. There were several good baskets of carrots, endives, lettu-

ces and peas,—a fow heads of cauliflowers, and a large supply of turnips, of two or three varieties—of cabbages of the finer sorts (the early york), and of nole-kole, there was a small assortment, with several bundles of asparagus, now quite out of season. The onions, leeks and French beans made a fair display; and among the rarer sorts may be classed tho Scotch kale, water cress, horse-radish and asparagus-bean. The celery was very poor, the potatoes indifferent, and the radishes overgrown.

There were several good varieties of plantain, and a fow baskets of sapotas; these excepted, the collection of fruits was very inferior to the vegetablo.

Further interesting particulars regarding the valuable properties of Aristolochia indica and Cissampelos convolvulacea, as antidotes to snake-bites.

A highly interesting and valuable communication from R. Lowther, Esq. giving further details regarding the useful property of *Aristolochia indica (Ishurmool,)* as an antidote to snake-bites, was next brought to the notice of the meeting. Mr. Lowther states, that since his former communication to the Society, ho has had proofs of the value of this plant as a specific, and he then proceeds to narrate soveral cases.

In tho same communication Mr. Lowther encloses a leaf, which although different in shape and texture from that submitted with his former letter read at the September meeting of the Society, appears to him to be another species of Aristolochia. The plant, Mr. Lowther observes, is not uncommon in his district, and the powdered root has been administered in snake bites with the most decided success.

The Secretary intimated that at Mr. Lowther's request he had referred the leaf in question to a member of the Society (Capt. Munro), from whom he had received tho following reply :—

" The leaf Mr. Lowther sent me is not an Aristolochia at all, but is *Cissampelos convolvulacea,* a very common plant all over India It belongs to the natural order *Menispermeæ,* which contains very many valuable medicinal plants, amongst others the Columbo root. Roxburgh also mentions one of the samo family, *Cocculus accuminatus,* as a remedy for snake-bites. His words are—" This root is used as a cure for the bites of venomous snakes. It is rubbed between two stones and given as a drink with water. However, tho natives themselves confess they have very little opinion of its virtues." I think that as the roots of so many species of this family are used successfully in various disorders, it is very natural to suppose that the plant in question may also possess some valuable properties. With regard to the snake stones mentioned by Mr. Lowther, I would observe, that although I have never witnessed, I have heard of many cases effected through thoir agency. Kæmpfer, in his *Æmenitates exiticæ* in 1712, mentions somo very curious facts regarding the snake stone."

Referring to the above extract of Captain Munro's note, the Secretary brought to the recollection of the meeting, that about three years ago he had presented a communication to the Society from Colonel H. C. M. Cox, bringing to notice the valuable property of the above plant; (Cissampelos convolvulacea, *vern: Dukh nirbirsee)* and that, at his requisition, that officer had sent down a quantity of the root, which he (the Secretary) had transferred to the Medical Board, for distribution among the principal hospitals of the city, that its efficacy as a remedy for snake bites might be readily and satisfactorily ascertained. The last communication he had received from the Board was to the effect, that no opportunities of testing its supposed virtues as an antidote to snake bites had then (December last) been afforded.

In connection also with the above subject, the Secretary submitted a note he had just received from Dr. McClelland, Officiating Superintendent of the Botanic Garden, forwarding a letter from Dr. Turner, Civil Assistant Surgeon at Midnapore, containing an abstract of casualties in that district from the bite of venomous serpents, amounting to no fewer than 402, from January 1845 to October 1846. Dr. Turner, attracted by Mr. Lowther's former letter, accordingly requests to be furnished with a supply of seeds of *Aristolochia indica,* and forwards specimen of a plant known at Midnapore by the name of "Abur" or "Churchirra," and *said* to be an effectual antidote to snake bites and valuable in other respects, but the botanic name of which he is not aware.

Dr. McClelland remarks, "the number of casualties in Dr. Turner's list seems to be great, but there can be little doubt of the accuracy of the returns, which shows how important the subject is. I have accordingly directed that those plants which have the best reputation as remedies in such cases shall be cultivated for public distribution. I herewith annex a list of them, and may remark that the plant which accompanied Dr. Turner's letter is *Achyranthes aspera,* Willd."

Capt. Munro observed, that to the best of his belief, neither the plant in question nor the family to which it belonged was at all known as affording any valuable medicinal properties.

All the above communications were referred to the Committee of Papers for publication in an early number of the Journal.

Communications on various subjects.

The following papers and letters were also submitted:—

1. From R. H. Irvine, Esq., M.D., presenting an interesting paper on the products and resources of Darjeeling.

2. From Cecil Beadon, Esq., Under-Secy. to Govt. of Bengal, forwarding copies of reports from October 1845 to September 1846, from the Supt. of Government cotton farms at Dacca.

These two communications were referred to the Committee of Papers.

3. From J. Dunbar, Esq., Commissionor of Revonue, Dacca, enclosing a lettor to his address from the Superintendent of the Government cotton farms at Dacca, which contains a request for the loan of tho cast-iron *Churkas*, in the Society's museum. *Resolved*—That this application be complied with, and that Mr. Price be requestod to furnish the Society with a report on the working qualities of these machines.

4. From W. Haworth, Esq., submitting the opinion of an experienced party on the samplo of wool, the produce of a first crop between a Cape Merino and Jusselmore sheep—presented at the last meeting by Mr. Hamilton Bell, of Agra.

5. From Capt. Hugh Robison, dated Aurungabad, 13th November, giving the result of two experiments for preserving the vitality of seeds.

A letter from the Librarian of the Public Library was also read, intimating the readiness of the Curators to co-operato with the Society in railing tho Metcalfe Hall, and paying half tho expenso that may be incurred for the work.

The Secretary submitted a few estimates for different kinds of railing, and it was agreed, that the same be referred to tho Finance Committee for settlement in communication with the Curators of the Library.

For the above presontations and communications, the best thanks of tho Society were accorded.

Report of the Agricultural and Horticultural Society of India for the year 1846.

The close of another year of the Society's existence renders it necessary to offer a short summary of the objects which have engaged its attention since the submission of its report for 1845.

Introduction.

The subject which naturally first claims attention has reference to the internal economy of the Institution. It is therefore satisfactory to mention, under this head, that since the close of last year, fifty-six* new members have been added to the list. Of these, thirteen are civilians in the service of Government, sixteen are merchants and traders, fifteen are indigo planters, ten are military officers, one is a minister of the Gospel, and one is of the legal profession. The loss from deaths has been rather more than that of last year, but less by resignations. There have been fourteen deaths and twenty-four resignations; to which must be added, six more names removed from the list on account of insolvency and non-payment of subscriptions; making in all forty-four.

Economy of the Society.

The following tabular statement affords the details more fully, and represents, at the same time, an analysis of the constitution of the Society :—

	In 20 former years	In 1841.	In 1842.	In 1843.	In 1844.	In 1845.	In 1846.	Gross Total.	Total real number at the close of 1846, after deducting lapses.
Honorary Members, ...	8	2	0	1	0	0	1	12	10
Free Members, ...	0	0	1	0	1	0	0	2	2
Corresponding Member, ...	0	0	0	0	0	0	1	1	1
Civilians in the service of Government, ...	152	19	21	14	17	9	13	244	170
Merchants and Traders, ...	129	13	18	16	10	15	14	215	135
Indigo and other Tropical Agriculturists,	139	21	7	15	6	2	15	205	94
Military Officers, ...	102	21	4	16	4	13	10	170	99
Medical ditto, ...	54	10	9	1	4	2	0	80	24
Asiatics, ...	37	8	6	5	1	6	2†	65	36
Clergy, ...	10	1	1	1	0	1	1	15	4
Law Officers, ...	28	0	6	2	2	2	1	41	25
Miscellaneous, ...	5	0	2	0	2	0	0	10	6
	664	95	75	71	47	50	58	1058	606

* The tabular statement represents the number as 58 ; but this is caused by the transfer of Dr. Wallich's name to the list of Honorary Members, and that of Dr. J. V. Thompson to the list of Corresponding Members, from the list of medical officers in which they were previously placed.

† These are engaged in mercantile pursuits.

Of this number (606), thirty-seven are members who have compounded for their subscriptions; one hundred and twenty-six are absent from India, ten are honorary, one a corresponding, and two are free members; leaving four hundred and thirty as the actual number of *paying* members on the books of the Society, or nine more than last year.

Economy of the Society.—Additional support from indigo-planters.

The Society remarked in the last report on the small addition to its ranks during 1845 from so numerous and respectable a body as the indigo-planters. It is happy to observe, that such has not been the case in the course of the past twelve months; for more than one-fourth of those who have been admitted during that period, belong to that class. The Society trusts that an equal, if not larger, number will enrol their names during next year; for on whom should an Institution of this nature more rely for support than on a body of gentlemen whose avocations are so intimately connected with pursuits, the promotion of which, constitutes the primary objects of the Society.

Economy of the Society.—Apathy of the native members of the community.

On a former occasion the Society alluded with regret to the very little degree of interest exhibited by the native members of the community in regard to its proceedings. It would take this opportunity of again referring to the subject. It will be seen by a glance at the foregoing tabular statement, that the number from this class, instead of increasing in a proportionate ratio during the last six years, *has actually decreased.* In 1840, this section of the Society numbered thirty-seven. In 1846, it is represented by thirty-six only, or less than one-fourteenth of the total number of members! It was scarcely to be expected, when the Society was first established, that this class of the community would join it readily; it was proper that the European portion should lead the way, and it did so. But it was hoped, that as education advanced among them, they would begin to perceive how much their interests could be promoted by the agency of this Society, and that its objects would meet at their hands a cordial support. That this just anticipation has not hitherto been realized, though the cause of education has, in the meantime, been progressing, is much to be lamented. The Society is not however willing to allow, in this instance, the experience of the past to be taken as a criterion for the future. It would rather express the

hope, that this apathy will no longer exist, and that the few members who form the exception, will also exert their influence towards inducing their brethren to join an Institution, from the labors of which, they will ultimately be the greatest gainers.

Economy of the Society.—Necrology. C. K. Robison, Esq.

Not only has the loss which the Society has sustained by death been numerically greater than that of last year, but it has also met with a calamity of no ordinary nature in the demise of C. K. Robison, Esq., a Vice-President and one of its oldest members. Joining the Society shortly after its formation, the late Mr. Robison proved himself a warm and steady supporter of its interests during the period of its infancy—when its members were by no means so numerous and influential as at the present day—and continued to take the same active part in its proceedings till the close of life. During a connection of twenty-three years, he held for five years the post of Honorary Secretary, and nine years that of a Vice-President. The various papers published in the earlier volumes of the "Transactions" bear witness to his zeal for the promotion of the objects for which the Society was instituted; and his continued services during later years, when assisting at the monthly meetings, and at the periodical public exhibitions held for the purpose of encouraging an improvement in horti-floriculture, are too well known to need further detail. The Society cannot, however, withhold the republication in this report of the following resolution, though it already forms a part of the proceedings of the meeting at which it was passed:—

"That this Society on holding its first meeting after the lamented death of C. K. Robison, Esq., is desirous of placing on record its sense of his valuable services during a period of 23 years, as Member, Honorary Secretary and Vice-President, and as Architect of the building occupied by the Society; and that a copy of this resolution, with a letter expressive of the deep regret of the Society at his death, be addressed to his family."

The demise of this useful and zealous member is now again recorded with feelings of deep regret.

The other members who have been lost to the Society, are Major George Broadfoot, of the Madras Army; Capt. P. Nicolson, of the Bengal Army; Captains D'Arcy Todd and E. Buckle, of the Bengal

Artillery; Mr. George Gillanders, Merchant; Baboo Dwarkanauth Tagore; Mr. N. Hudson, Solicitor of the Supreme Court; Mr. W. Cracroft, late of the Civil Service; Mr. E. L. Ryder, Merchant; Baboo Nundololl Sing; Mr. Thomas Young, of the Civil Service; Dr. George Playfair, and Captain G. H. Edwardes, of the Bengal Army.

Award of an Honorary Membership to Dr. Wallich.

The Society has also experienced a loss by the return to Europe, after a long residence in India, of Dr. Wallich, late Superintendent of the H. C. Botanic Garden at this presidency. Dr. Wallich is one of the very few members, now living, who joined Dr. Carey in the establishment of the Society six and twenty years ago. During the greater part of a quarter of a century he has taken an active share in its proceedings; and has been in a position, not only in his capacity of an Honorary Secretary (which post he held for sometime) and a Vice-President, but also in that of Superintendent of one of the most liberally supported Botanical Institutions in the world, to afford his advice and assistance in various ways towards furthering the objects of the Society. In acknowledgment of these services the Society has enrolled the name of Dr. Wallich on its list of Honorary Members.

Agricultural Department.—Wheat, barley, and other seeds from the Court of Directors.

The donation by the Court of Directors of a splendid supply of cereal and other seeds was alluded to in the last annual summary, and a few details connected with their distribution were likewise given. The Society regrets to record that the reports which have been received during the year from the various parts of the country where these seeds were distributed, are by no means so favorable as could be desired. The cereals appear to have failed in all localities, and experiments with other sorts (rape, hemp, flax, tare, mangul-wurzel, &c.), proved but partially successful. This cannot however, be deemed a fair trial for the introduction of superior descriptions of exotic field produce into India, as the consignment did not come to hand before October, and did not reach many localities in the Upper Provinces till more than a month afterwards; far too late for sowing most of these varieties, especially wheat and barley; and which circumstance has been referred to in nearly every report presented to the Society. A long tabular statement of the result of these experiments has been forwarded to Professor Royle, at

the India House, and his attention has been drawn to the cause to which the failures have been principally attributed, in order that, should the Court be pleased to furnish a second consignment, it may be despatched earlier in the season to admit of the seeds being put in the ground at the commencement of the *rubbee* sowings.

Agricultural Department.—Carolina paddy.

A still more untoward result has attended the measures which were adopted in 1845 by the Government of Bengal for the introduction of Carolina paddy into Arracan, the large supply, consisting of 500 maunds, which was received in March last, having failed in every part of that province where its growth was attempted. And not only so, but reports of a similar disheartening nature have reached the Society from all those to whom small supplies were sent from a few maunds which the Government placed at its disposal; proving that the seed must have completely lost its germinating power before it reached its destination, though its outward appearance, when received from board-ship, was as satisfactory as could have been desired. The Government have ordered a second consignment of a similar quantity, (through the medium of the Society,) to be shipped from the United States immediately after the grain has been reaped. The Society has spared no trouble in the directions it has given the agents as regards the mode of transmitting this supply; and hopes to be able to record on a future occasion, that this second attempt for the introduction of so superior a description of rice into India, has proved more successful than the first.

Agricultural Department.—American Sumach.—Award of gold medal to Mr. Teil.

Allusion was made in the last report to the American Sumach or Dividivi *(Cæsalpinia coriaria)*, and to the propriety of its general culture in India on account of its valuable tanning properties.*

* "The American Sumach deserves to be extensively cultivated in this country. It seems to thrive remarkably well, requiring very little, if any care, except in its youngest state; and a proportionally small expenditure of money. The tree seems to be contented with a very ordinary sort of soil, and in all probability, when once reared from seeds ripened in the country, it will be as productive as in its own native climate, at least sufficiently productive to make the cultivation of the tree an object of impertance. Again and again I recommend this Sumach to be widely cultivated in this part of the world."—*Extract of Dr. Wallich's letter to the Secretary.*

In the early part of the year Dr. Wallich, by whom the plant was first introduced to the notice of the Society, submitted a correspondence between himself and Mr. Teil, of Kidderpore, giving the result of certain experiments with this product, the growth of the Calcutta Botanic Garden; and presented, at the same time, several specimens of leather illustrative of these experiments. To mark its sense of Mr. Teil's disinterested services in thus bringing to public notice the useful properties of this tree, and proving that its tanning principle had not been in any degree weakened by change of soil and climate,* the Society has been pleased to award him its gold medal.

Horti-floricultural Department.—Imported vegetable and flower seeds.

The Society regrets to observe, it has been very unfortunate in regard to its annual supply of imported seeds; the flower seeds from England having failed to germinate, and the splendid consignment of vegetable and flower seeds from the United States, amounting to Rs. 1,700, having been totally lost by the wreck of the *Arragon* at the mouth of the Hooghly. The seeds from the Cape have proved good, and given, the Society believes, general satisfaction.

With the view of remedying, if possible, the constant failures which have occurred in the seeds received from England, the Society, on the recommendation of its Committee, has determined on obtaining—notwithstanding the expense—the whole of the supply for next year's distribution, by the overland conveyance, to reach this in the early part of October, thereby enabling the seedsman (Mr. Carter,† of London) to give seeds of the latest gathering. The Society has likewise increased the supply from America; and trusts there will be no cause for complaint next year in regard either to the quality or quantity of the seeds which will then be distributed.

* The imported Sumach, such as I have received from America, notwithstanding every possible care in the selection, cannot, as I have before explained, be compared to the Sumach grown by you either for beauty of color, or for strength in tanning properties. It therefore appears to me either that the soil of India is better adapted for its growth than that of America, or that uncommon care was taken in the growth of the Sumach you were pleased to send me.—*Extract of Mr. Teil's letter to Dr. Wallich.*

† The preference was given to Mr. Carter, he having offered to forfeit the cost, if the seeds did not germinate, provided the mode of packing and transmitting was left to his management.

Horti-floricultural Department.—Vegetable, fruit, & flower shows.

Only two shows of vegetables and fruits have been held during the year, in consequence of the repairs to the Town Hall—the only building suitable for the purpose—having interfered with the period fixed for the third show, namely, in May. At those held in February and December, the sum of Rs. 240 was awarded.

Four exhibitions of flowers have taken place during the same period, namely, in February, April, August, and December, and the total sum awarded as prizes for best specimens amounts to Rs. 421, of which, the sum of Rs. 400 has been contributed by Sir Lawrence Peel, the patron of Indian floriculture. Considering that these shows are yet in their infancy—having been but two years in existence—the Society has reason to be satisfied with the progress which has already been made, and which may be regarded as an earnest of greater improvement as respects the introduction of rarer varieties, and the improvement of indigenous plants. There is, however, one material point on which the Society would desire to observe a change,—and that respects the spirit of competition displayed at these shows. It cannot be denied that the number of exhibitions has hitherto been fewer than could be wished, thus confining the prizes principally to the produce of some twelve or fifteen gardens, instead of distributing them over double that number. The Society hopes in its next summary to be able to report an improvement on this head.

Nursery-Garden.—Overseer's house, Conservatory and Vinery.

Several improvements have been carried out during the year in the Nursery, under the superintendence of the Garden Committee. A good substantial house, in the place of the former *cutcha-pucka* bungalow, has been erected as a residence for the Overseer. A small conservatory has been likewise built, the same being much needed for preserving plants of a rarer sort; and the new flower garden, to which allusion was made in the last summary, has been completed by the laying down of good *pucka* walks throughout it. The outlay for these works has amounted to Rs. 1,150, as detailed in the statement of receipts and disbursements. In addition to the above, the sum of Rs. 83 was voted at the close of the year for a *Vinery*, principally for the purpose of testing, if the plan of growing the grape on high

walls, a certain distance apart, is well suited for increasing the healthiness of the vine, and the size of the fruit.

Nursery-Garden.—Sugarcane culture.

The distribution of sugarcane during the season has been very good. Rather more than 37,000 have been disposed of, leaving a stock of about 10,000 to meet a demand during January and February of next year. In consequence of the call for the China and Singapore varieties having been greater during 1845, than the supply, the Committee have considerably increased their cultivation, and they now bear about an equal proportion to the other sorts. The return from the canes already sold has more than reduced three-fourths of the ordinary expenses of the garden.

Nursery-Garden.—Fruit trees and other useful cultures.

The greater part of the piece of ground which was reserved in 1845 solely for the purpose of raising fruit trees of superior varieties, has been stocked, and the Committee intend commencing the distribution of grafts therefrom next rainy season. At first, this will be necessarily on a small scale, but in the course of time the Society hopes to increase it considerably, so as fully to carry out the original intention of the Committee, namely, the supplying of all applicants, members of the Institution, with grafts from *approved stocks*, with the view of remedying, in some measure, the complaints that are made of the uncertainty of supplies obtained from native gardeners who, as is generally well known, substitute a common variety for a good one, charging at the same time the full price of the latter,—a deception which is frequently not discovered till it is too late to remedy it. And here it may not be out of place to mention, that the Committee will, at all times, be glad to receive and acknowledge contributions, either to the fruit or flower departments of the garden, of choice grafts or rare plants, and will also guarantee that every care and attention shall be bestowed on them, and the result duly reported. The same remark is indeed applicable to *all* plants, whether used as food for man or for economical purposes; it being an object to render this Nursery a depository for all useful productions of better species than the indigenous, with the view of propagating them for the purpose of distribution and introduction into such parts of the country as may be considered fit for their growth. In this

way some good has already been effected by the culture and general distribution, during the last ten years, from this Nursery, of sugar-cane of superior sorts;* of arrow-root; tapioca; guinea grass; West India ginger; American maize: and of later years, of the description of mulberry from the Philippine islands *(Morus multicaulis)*, so well adapted for silk-worm feeding; the Mauritius Screw-pine *(Pandanus vacoa)*, the leaves of which are used in that island for making sugar bags; the Tenasserim and Brazilian yams; with tobacco of superior foreign descriptions.

Metcalfe Hall.—Call for contributions to museum.

The Society has the pleasure to mention by way of record, that it took possession, in the early part of the year, of its apartments in the lower floor of the Metcalfe Hall. Having now a commodious local habitation, it is in a position to receive and display, in a proper manner, all contributions which may be made to its museum either by members or by the community at large. It would avail itself of this opportunity to offer its acknowledgments to those who have already assisted in this department, and urge a continuance of such assistance. Specimens of vegetable oils,—of which India furnishes such a variety —of gums, gum-resins, tanning and dying substances, of woods,†

* Since the year 1838, when the Society commenced distributing, to the present time, that is, during nine years, upwards of two hundred and twenty thousand canes of sorts have been sent from this Nursery to various parts of India.

† The Society has received from Capt. S. F. Hannay, Commandant of the Assam Light Infantry Battalion, a large and valuable collection of specimens of the principal timber trees of Upper Assam; from Lieut. W. F. Nuthall, of the 18th Bengal N. I., an equally large assortment of woods indigenous to Arracan; and from Mr. C. B. Taylor a collection from the Jungle Mehals. Col. H. C. M. Cox has also contributed a few, the growth of Central India; and Capt. S. R. Tickell, two or three sorts from Chota Nagpore. These form a fair beginning towards a collection which, in due time, the Society hopes to obtain from all parts of the country.

It would however add considerably to the value of specimens were they accompanied by the leaves and flowers of the trees producing them, that no difficulty might be experienced in affixing their botanic names. Native names can seldom be depended on, seeing that they differ so considerably in various districts. In addition to the above mentioned, the Society has been presented with two tables manufactured of teak and sisso and a box of mahogany, the produce of the H. C. Botanic Garden, Calcutta; the two former, the gift of the late Mr. Robison, the latter of the Government of Bengal.

wild silks, fibrous substances, &c., and of any newly introduced cultures will, at all times, be most acceptable, as aiding in the formation of a museum of our many hitherto little known or neglected products, and which may serve as a means of reference to all who are interested in developing the resources of the country.* Models of agricultural or other implements will also be thankfully received.

Metcalfe Hall.—Bust of Dr. Carey, Picture of Sir E. Ryan.

The bust of the venerable founder of the Society has been placed in the spot originally designed for it, the north end of the meeting room. The picture of Sir Edward Ryan, (for many years a President of the Institution) which has been lately received, ornaments the southern end of the same apartment.

Branch Societies.

The various Branch Societies have been zealous in the work for which they were instituted, that at Bhauglepore in particular. A reference to the detailed reports of this branch, as published periodically in the Journal, testify the flourishing condition to which it has already attained, and prove what a stimulus has been afforded through its exertions, as respects a spirit for agricultural improvement among the zemindars and others, not only in its own immediate locality, but also in the neighbouring districts.

Literary Department.—Journal.

During the past twelvemonths, four parts of the Journal have issued from the press, viz. :—Part IV of volume IV, and three parts of volume V, which are equivalent to one volume. The Society is indebted to

* Whilo this summary is being drawn up, the Secretary has received a letter from Professor Royle, extract of which is here given, as corroborative of one of the uses to which a museum of this sort may bo applied :

"You mention receiving cereal gums and resins. Might I suggest, that if you were to send me specimens of them, I should be able to shew them to brokors and manufacturers who are constantly making enquiries of me respecting now products that can be turned to account." And again,—in allusion to a quantity of kino, the produco of *Pterocarpus marsupium*, sent to the Society from Palamow, by its indefatigable and zealous correspondent Mr. C. B. Taylor, to whom the Society is also indebted for various specimens of oils, the produce of the forests of the same district—Professor Royle remarks,—"I am glad to find that you are likely to have some genuine kino from your own presidency. It would sell here in large quantities, but it is too dear for use in tho arts."

the Governments of Bengal, Bombay, and the N. W. Provinces, for several papers which they have placed at its disposal, and which have appeared in the pages of the above numbers. To its correspondents generally, it would also take this opportunity of acknowledging its obligations and urging a continuance of their efforts in the same cause.

Conclusion.

Having now glanced at the principal topics which have engaged its attention during the year, the Society would, in conclusion, call upon all its members and correspondents, to aid in advancing, in a still greater measure, the objects for which it has been instituted, by the communication of such facts relating to the agriculture of their respective districts as may come within their notice. For, it cannot be too often reiterated, that such facts, however trifling they may appear to the communicants, may nevertheless, in a collected form, possess some interest, and may possibly afford assistance to others engaged in similar pursuits in various parts of the country.

Report of the Finance Committee.

The Finance Committee have the pleasure of submitting the following report, explanatory of the pecuniary transactions of the Society during the year 1846.

The *Receipts* for the past year have been Co's. Rs. 21,227 : 15 : 1, including the temporary additional subscription on account of the Society's proportion of the debt for the Metcalfe Hall of Rs. 2,200; Rs. 820 for proceeds of sugar-cane delivered from the Nursery Garden, and Rs. 173 : 2 : 9, the balance of the Carey Testimonial Fund.

The *Disbursements* for the same period amount to Rs. 26,704 : 15 : 4, which include Rs. 1,000 invested in Government Securities; Rs. 6,398 on account of the debt on the Metcalfe Hall; Rs. 363 : 2 : 6 for furniture, and Rs. 457 : 10 for a marble pedestal for Dr. Carey's bust, and for the erection of out-offices for servants.

The *Ordinary* expences of the Nursery Garden, amounting to Rs. 2,016, will be nearly provided for by the sale of sugar-canes; Rs. 820 having been already realized, and about Rs. 800 being in the course of collection.

The *Extraordinary* expenses have been much increased by the necessity of building a new house for the Overseer at a cost of Rs. 925, and the expence attendant on the erection of the conservatory and vinery, authorized by the Society.

It has been stated, that the *total receipts* for the year have been Rs. 21,227 : 15 : 1, and the *total disbursements* Rs. 26,704 : 15 : 4. There were, however, at the close of 1845, in the Bank of Bengal and with the Government Agent, balances to the extent of Rs. 8,598 : 4 : 2. These balances, being added to the receipts, make up, in the aggregate, a sum of Rs. 29,826 : 3 : 3, from which has been made a payment of Rs. 4,538 : 12, in part of the loan of Rs. 5,000 alluded to in the last Report as having been obtained "for the purpose of liquidating the liabilities incurred for the completion of the Metcalfe Hall." The Committee have the pleasure to state, that there now remains the sum of Rs. 500 only to relieve the Society entirely of this debt.

The *Cash balance* on the 31st December 1846, amounting to Co's. Rs. 3,121 : 3 : 11, includes the undisposed sum of Rs. 1,309 : 5 : 6, on account of the Ryan Testimonial Fund, the majority of the subscribers to this Fund now in India, having transferred their respective subscriptions to the Society.

The Committee are glad of the opportunity to intimate to the Society, that there is much improvement in the state of their Funds: that after very heavy payments on account of the Metcalfe Hall, the new house for the Overseer, and other expences at the Nursery Garden, there has been an addition made to their vested Fund of Co's. Rs. 1,000, constituting that Fund at present in the amount of Co's. Rs. 11,933: and as no endeavors will be wanting on the part of their officers to collect the arrears, which unfortunately still exist to the same extent as last year, they express a hope that the next year will give a still more favorable result by the present report inducing subscribers to come forward to liquidate *demands* which have existed against some of the members for very long periods.

Calcutta: M. S. Staunton,

31*st December*, 1846. *Member of the Finance Committee.*

Statement of Receipts and Disbursements of the Agricultural and Horticultural Society of India, from 1*st January to the* 31*st December*, 1846.

RECEIPTS.

From Members subscriptions collected during the year for the ordinary purposes of the Society, ...			12,111 12 0
,, Ditto, additional temporary subscriptions to assist in meeting the Society's proportion of the debt on the Metcalfe Hall, ...		2,168 0 0	
,, Various other members, donation ditto ditto, ...		32 0 0	2,200 0 0
,, Government annual donation, ...		1,045 0 0	
,, Ditto monthly allowance for 12 months, at 135-13-6 per month, ...		1,630 2 0	2,675 2 0
,, Sir Lawrence Peel, donation to the Society for the year, to encourage the culture of flowers, &c.			400 0 0
,, Accruings of interest on fixed assets, ...			462 14 7
,, Proceeds of sugar-cane delivered from the Nursery Garden in 1846, ...		820 1 0	
,, Ditto of a portion of surplus Cape and American vegetable seeds sold in 1845 and 1846, ...		54 0 0	
,, Ditto of copies of the Transactions of the Society, ...		218 3 9	
,, Ditto of copies of the Journal of the Society, ...		54 3 3	
,, Ditto by advertisement inserted in Journal, ...		33 5 3	
,, Ditto of a quantity of old linseed, rape seed, and mustard seed, ...		13 0 0	
,, Ditto of old seed boxes of sorts, ...		25 12 0	
,, The Mirzapore Branch Agricultural Society, being the amount of 2 cases for plants paid by this Society in 1845 and 1846, ...		40 0 0	
By Transfer of balance from Carey Testimonial Fund account to Society's general account, ...		172 3 9	1,430 13 0
,, Balance of Ryan Testimonial Fund account, ...			*1,947 5 6
Total Receipts, Co's. Rs.			21,227 15 1
,, Balance in the Bank of Bengal on 31st December, 1845, ...		8,026 11 8	
,, Ditto in the hands of Government Agent on ditto, ...		571 8 6	8,598 4 2
Grand Total Co's. Rs.			29,826 3 3

DISBURSEMENTS.

Foreign Vegetable and Flower Seeds.

By C. N. Villet, for Cape garden seeds, ...		1,200 0 0	
,, Wrench and Sons, for English flower seeds, ...	553 13 6		
,, Vetch and Son, for ditto supplied in 1845, ...	278 3 0		
,, Mr. Carter, for ditto ditto, ...	255 5 0	1,087 5 6	2,287 5 6

* Rs. 638 of this amount have been already transferred to the Society.

Library.		
By Books purchased during the year for the Library, ...	169 10 0	
,, Binding books during the year, ...	20 8 0	
		190 2 0
Printing.		
,, Sundry parties, for printing receipts, &c.		69 8 0
Journal.		
,, Bishop's College Press, for printing Part 4 of Volume 4, and Parts 1 aod 2 of Volume 5, ...	1,248 6 0	
,, Lithographing plates for Journal, ...	88 0 0	
,, Ostell and Lepage, for paper for plates for ditto, ...	15 0 0	
		1,351 6 0
Nursery Garden.		
,, Ordinary expences incurred on account of the Nursery Garden, from 1st December 1845 to 30th November 1846, ...	2,016 1 0	
,, Additional expence (in full) for burning bricks for flower garden walks, ...	40 0 0	
,, Ditto for a Conservatory, ...	100 0 0	
,, Ditto for erecting a new House for Overseer, ...	925 0 0	
,, Ditto for ditto a Vinery, ...	83 0 0	
		3,164 1 0
Establishment.		
,, Amount for Establishment, from 1st December 1845 to 30th November 1846, ...		4,466 7 6
Medals.		
,, Hamilton and Co. for silver medals, ...		72 1 6
Pecuniary Rewards.		
,, Prizes to Mallees for vegetables and fruits, at the exhibitions held on the 2nd February and 3rd December,...	240 0 0	
,, Ditto to ditto for flowers, at the exhibitions held on the 24th February, 15th April, 29th August, and 29th December, ...	421 0 0	
,, The Bhauglepore Branch Society, annual donation, ...	50 0 0	
,, Overseer of Nursery Garden, a donation of, ...	100 0 0	
		811 0 0
Society's Vested Fund.		
,, The Government Agent, for the purchase of a 4-4 and 4-5 per Cent Government Promissory Notes to be added to the Vested Fund for 500 each, ...		1,000 0 0
Furniture for Metcalfe Hall.		
,, Currie and Co., balance of their bill for furniture, ...	188 4 0	
,, Sundry parties for various ditto, ...	174 14 6	
		363 2 6
Metcalfe Hall.		
,, Burn and Co., the Society's proportion of, and in settlement of their account with, the Metcalfe Hall Committee, ...	1,430 2 5	
,, Jessop and Co., ditto ditto, ...	1,034 8 8	
,, Union Bank, ditto ditto, ...	3,628 7 3	
,, Ditto, the Society's proportion of Interest on a note of hand of Rs. 6,000, ...	304 13 9	
		6,398 0 1

LOAN—METCALFE HALL.

By Bagshaw and Co., amount of Loan taken on 24th December, 1845, ...	3,000 0 0	
,, Ditto, Interest on ditto for 3*m*. 3*d*., at 5 per cent., ...	38 12 0	
,, Baboo Ramgopaul Ghose, in part of 1,000 Rs. advanced to the Society in October, 1845, to assist in liquidating debt on Metcalfe Hall, ...	750 0 0	
,, Rajah Shutteechurn Ghosal, ditto ditto, ...	750 0 0	
		4,538 12 0

ADVERTISEMENTS.

,, Advertising in the public prints, notices of general meetings, of shows of flowers and vegetables, distribution of seeds, sugar-cane, &c. &c. &c.,...		341 1 3

STATIONERY.

,, Stationery for office books, and for the use of the office, ...	62 7 6	
,, Ditto 11 reams of brown packing paper, for packing seeds, ...	110 0 0	
		172 7 6

CAREY TESTIMONIAL.

,, Holmes and Co., an advance for a marble Pedestal for Dr. Carey's Bust, ...		250 0 0

GODOWN.

,, Erecting two Godowns for Servants at Metcalfe Hall,... ...		207 10 0

FREIGHT.

,, Freight on boxes of seeds, books, &c. sent and received from Cape, England, America, &c.		109 7 0

POSTAGE AND SUNDRY OTHER CHARGES.

,, Postage on the Journal, on letters sent and received, and for petty expences, ...	730 0 0	
,, The Botanic Garden, for 2 plain plant boxes for plants for the Mirzapore Branch Society, ...	20 0 0	
,, Eggs of silk-worms procured on account of Government, ...	5 8 0	
,, Amount advanced by Villet and Son for insuring Cape garden seeds, ...	45 0 0	
,, Preparing sundry specimens of Wood from Assam and Arracan, ...	13 6 6	
,, Preparing, &c. 2 packing cases for two clay busts of Lord Metcalfe, sent to Agra and Delhi, ...	19 0 0	
,, Extra Packermen for subdividing seeds,...	21 9 0	
,, Presents to Constables and Burkundauzes for attending at Horticultural and Floricultural exhibitions during the year,...	58 0 0	
		912 7 6
Total Disbursements Co's. Rs. ...		26,704 15 4
,, Balance in the Bank of Bengal on 31st December 1846, ...	3,086 12 10	
,, Ditto in the hands of Government Agent on ditto, ...	34 7 1	
		3,121 3 11
Grand Total, Co's. Rs. ...		29,826 3 3

Disbursements.

To amount of Dishursements during the year 1846, as per Statement, ...		26,704 15 4
,, Balance in the Bank of Bengal on 31st December 1846, ...	3,086 12 10	
,, Ditto in the hands of Government Agent on ditto, ...	34 7 1	
		3,121 3 11
Total Co's. Rs. ...		29,826 3 3

Bills Payable and Liabilities.

Amount due to Bishop's College Press, for printing Part 3 Vol. v. Journal of the Society, ...		337 4 0
Balance of amount of Loan taken from Rajah Shutteechurn Ghosaul withont interest,	250 0 0	
Ditto of ditto from Bahoo Ramgopaul Ghose ditto, ...	250 0 0	
		500 0 0
Amount for prizes for improvement in Indian Churka, ...		620 0 0
Printing and hinding charges for Mr. Fenwick's Vernacular Hand-Book of Gardening, exclnsive of lithographs, say ...		700 0 0
Total Co's. Rs. ...		2,157 4 0

Receipts.

By amount of Receipts during the year 1846, as per Statement, ...		21,227 15 1
,, Balance in the Bank of Bengal on 31st December 1845, ...	8,026 11 8	
,, Ditto in the hands of Government Agent on ditto, ...	571 8 6	
		8,598 4 2
Total Co's. Rs. ...		29,826 3 3

Dependencies.

Amount invested in Government Securities lodged in the Government Agency Office,	11,933 5 4
Amount of Subscription in arrear, ...	10,263 12 3
Amount proceeds for sugar-cane not yet realized, about, ...	800 0 0
Total Co's. Rs. ...	22,997 1 7

LIST OF MEMBERS

OF THE

Agricultural & Horticultural Society

OF

INDIA.

DECEMBER 31*st*, 1846.

Patron:

THE RIGHT HONORABLE LORD HARDINGE, G. C. B.,

GOVERNOR GENERAL OF INDIA, ETC. ETC.

OFFICE BEARERS.

President:

SIR JOHN PETER GRANT.

Vice-Presidents:

SIR LAWRENCE PEEL.
W. STORM, ESQ.
BABOO RAMGOPAUL GHOSE.

Honorary Secretary:

JAMES HUME, ESQ.

Deputy Secretary & Collector:

A. H. BLECHYNDEN, ESQ.

List of Members.

* This mark denotes Members, who have compounded for their Annual Subscriptions.

† This mark denotes Members, who are absent from India, and therefore Non-contributors.

‡ This mark denotes Members, who though absent, are desirous of continuing their Subscriptions.

HONORARY MEMBERS.

The Right Honorable Sir Edward Ryan, A.M., F.A.S., London.
Baron Von Ludwig, Cape of Good Hope.
Charles Huffnagle, Esq. M.D.
John Forbes Royle, M.D., F.R.S., F.L.S., F.G.S., Professor of Materia Medica, King's College, London.
Colonel John Colvin, C.B., London.
Thomas Waghorn, Esq.
J. Mackay, Esq.
Don Ramas de la Sagra, Island of Cuba.
Dr. Justus Liebig, Professor of Chemistry in the University of Giessen.
N. Wallich, M.D., F.R.S., F.L.S., London.

ORDINARY MEMBERS.

Abercrombie, Captain William, Bengal Engineers, Jullunder Dooab.
Abbott, H. W. Esq. Dep. Secy. Union Bank, Calcutta.
Abbott, W. H. Esq. Junior, Attorney, Calcutta.
Adam, George Ure, Esq. Merchant, Calcutta.
Agabeg, Joseph, Esq. Merchant, Calcutta.
Ainslie,† William, Esq. Merchant.
Ainslie,† Daniel, Esq. Merchant.
Alexander,† Nathaniel, Esq. Merchant.
Alexander,† J. W. Esq. Assignee of Insolvent Estates, &c.
Alexander, William Stewart, Esq. Civil service, Bhauglepore.
Alexander, Henry, Esq. Civil service, Calcutta.
Allan, John, Esq. Merchant, Calcutta.
Allan, Robert Townsend, Esq. Attorney, Supreme Court, Calcutta.
Allen, C. Esq. Civil service, Agra.

Alves,† Colonel N.
Anderson, Wm. Esq. Indigo planter, Bagnan.
Andrew,† John, Esq. Merchant.
Anstruther,† The Honorable P. Esq.
Ashootos Dey, Baboo, Merchant, Calcutta.
Atherton, H. Esq. Civil service, Burrisaul.
Atkinson, Thos. James, Esq. Indigo planter, Burdwan.
Auld, S. J. Esq. Indigo planter, Gurbetah.
Austin,† George, Esq. Indigo planter.
Aylwin,† D. C. Esq. Merchant.

Baillie,† Neil Benjamin Edmonstone, Esq.
Balfour, G. G. Esq. Civil service, Patna.
Balfour, Lewis, Esq. Merchant, Calcutta.
Barlow, Robert, Esq. Civil service, Calcutta.
Baron,* P. Esq. Indigo planter, Shajehanpore.
Barton, George, Esq. Merchant, Calcutta.
Beadon, Cecil, Esq. Civil service, Calcutta.
Beaufort, Francis L. Esq. Civil service, Howrah.
Becher, John Edward, Esq. Indigo planter, Tirhoot.
Bell,† R. C. Esq. Indigo planter.
Bell, H. Hamilton, Esq. Landholder, Agra.
Bellairs, F. Esq. Merchant, Calcutta.
Belli, W. H. Esq. Civil service, Calcutta.
Bennett, William, Esq. Soubutpore Factory, Commercolly.
Bentall,* Edward, Esq. Civil service, Jessore.
Beresford, H. B. Esq. Civil service, Mymunsing.
Bidwell, Alfred Clarke, Esq. Civil service, Hooghly.
Bindabun Misry, Baboo, Merchant, Calcutta.
Birch,* Captain Frederick William, (41st Regiment N. I.) Police Magistrate, Calcutta.
Birch, Lieut.-Colonel R. J. H. Judge Advocate General.
Birjonauth Dhur, Baboo, Merchant, Calcutta.
Biscoe,† Thomas Porter, Esq. Civil service.
Bishop, Captain G. W. Commanding Sappers and Miners at Darjeeling.
Blake,† C. H. Esq.
Bluntish, Robert, Esq. Paymaster H. M. 9th Regiment, Meerut.
Bogle, Major Archibald, (2nd Regiment N. I.) Commissioner of Arracan, Akyab.
Boldero, John Stephen, Esq. Civil service, Agra.
Bowring,† Samuel, Esq. Civil service.
Boyd,† W. S. Esq. Merchant.
Boyle, E. Esq. Merchant, Calcutta.
Bracken, William, Esq. Civil service, Calcutta.
Bracken, Thomas, Esq. Secretary Bank of Bengal, Calcutta.
Braddon,† William Clode, Esq. Merchant.
Bradley, W. H. Esq. Madras Medical service, Aurungabad.

Brae, Thomas, Esq. Indigo planter, Mahomedpore.
Brandreth, E. L. Esq. Civil service, Ajmere.
Brodie,* Lieutenant T. (10th Regiment N. I) Principal Assistant to the Commissioner of Assam.
Brooke, Lieutenant John C. (63rd Regiment N. I.) Adjutant, Meywar Bheel Corps.
Brown, Forbes Scott, Esq. Merchant, Penang.
Brown, W. D. Esq. Merchant, Akyab.
Brown, J. C. Esq. Civil service, Kishnaghur.
Brownlow, Henry, Esq. Civil service, Shahabad.
Bruce, Lieutenant H. LeG. Horse Artillery, Umballah.
Bruce, C. C. Esq. Merchant, Calcutta.
Buckland, R. H. Esq. Merchant, Calcutta.
Buckland, C. T. Esq. Civil service, Chittagong.
Buller,* Frederick Pole, Esq. Civil service, Shajehanpore.
Bullen, Robt. Esq. Merchant, Mauritius.
Burnett, Captain F. C. (Artillery), Dum-Dum.
Burt,† Benjamin, Esq. M.D.
Bushby, George Alexander, Esq. Civil service, Calcutta.
Butcher, Charles, Esq. Indigo planter, Dacca.
Byrne, Wale, Esq. Head Assistant Judicial and Revenue Departments of Government, Calcutta.

Caird, Thomas, Esq. Emigration Agent, Calcutta.
Calleychunder Lahoree, Baboo, Dewan to the Rajah of Cooch-Behar.
Cameron, The Honorable C. H. Esq. Member of the Supreme Council, Calcutta.
Campbell, W. F. Esq. Merchant, Calcutta.
Campbell,† Donald, Esq. Merchant.
Campbell, Colin, Esq. Merchant, Calcutta.
Campbell,* Archibald, Esq. M.D. Medical service, Superintendent of Darjeeling.
Campbell, Lieut. Robert, (47th Regiment N. I.) Gowhatty, Assam.
Cardew,† Cornelius, Esq. Civil service.
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Spiers,† Captain William.
Sreekissen Sing, Baboo, Calcutta.
Sreekissen Mullick, Baboo, Calcutta.
Stacy, Colonel Lewis Robert, C.B. (43rd Regiment N. I.) Commanding at Neemuch.
Stainforth,† F. Esq. Civil service.
Stalkart, William, Esq. Merchant, Calcutta.
Staunton, M. S. Esq. Assistant Millitary Auditor General's Office, Calcutta.
Steel, Major James, (2nd European Regiment,) Agra.
Steer, Charles, Esq. Civil service, Dinagepore.
Stephenson,† R. M. Esq.

Stevenson,*† William, Esq. Junior, M.D.
Stewart,* Captain William M. (22nd Regiment N. I.) Fort Adjutant, Chunar.
Storm, William, Esq. Merchant, Calcutta, (Vice-President.)
Storm, John, Esq. Merchant, Calcutta.
Stopford,† James Sydney, Esq. Merchant.
Stokes, Lieutenant S. W. (Horse Artillery,) Meerut.
Stowell, C. S. Esq. Merchant, Meerut.
Strickland, R. S. Esq. Merchant, Calcutta.
Strong, F. P. Esq. Medical service, Calcutta.
Sturgis,† Henry P. Esq. American Consul, Manilla.
Sturt, R. R. Esq. Civil service.
Sutherland, Colonel J. Superintendent of Rajpootanah.
Sutherland, Patrick, Esq. Assistant Military Board Office, Calcutta.
Sutherland, Charles J. Esq. Merchant, Moulmein.
Sutherland, Thos. Esq. Merchant, Calcutta.
Suttoo Churn Ghosaul, Rajah, Calcutta.
Syme,† Andrew, Esq. Merchant.
Swatman, Captain William, (65th Regiment N. I.) Assistant Commissary General, Dacca.
Swinhoe, T. B. Esq. Attorney, Calcutta.

Talib Ally Khan, Zemindar, Gyah.
Taylor, C. B. Esq. Supt. of the Palamow Collieries, Rajharra.
Taylor, George, Esq. Barrister at Law, Calcutta.
Teil, John, Esq. Tanner, Kidderpore.
Terry, W. Esq. Indigo Planter, Midnapore.
Thomason, The Honorable James, Lieutenant Governor of the N. W. Provinces, Agra.
Thomson, R. Scott, Esq. Surgeon, Calcutta.
Thompson, J. V. Esq. M.D., F.L.S., Deputy Inspector General of Hospitals, Sydney, (Corresponding Member.)
Thornton, John, Esq. Civil service, Agra.
Thurburn,† R. V. Esq. Indigo planter.
Tickell, Captain S. R. (31st Regiment N. I.) Assistant to Commissioner of Arracan.
Tiemroth,† C. Esq.
Tiery, L. Esq. Indigo planter, Berhampore.
Todd,† James, Esq.
Tonnochy, Thomas, Esq. Deputy Collector, Bolundshohur.
Torrens, Henry, Esq. Civil service, Berhampore.
Torrens, Robert, Esq. Civil service, Calcutta.
Tremblehansen, W. C. Esq.
Trevor, Edward Tayler, Esq. Civil service, Kishnaghur.
Trotter,† John, Esq. Civil service.
Trotter, T. C. Esq. Civil service, Tirhoot.
Tucker, Charles, Esq. Civil service, Calcutta.
Tucker, Henry Carre, Esq. Civil service, Goruckpore.
Tulloh, C. R. Esq. Civil service, Jaunpore.

Turner,* Thomas Jacob, Esq. Civil service.
Turner, George, Esq. Medical service, Mirzapore.
Turton, Sir Thomas E. M. Bart. Ecclesiastical Registrar, Supreme Court, Calcutta.
Tweedie,† John, Esq. Indigo planter.
Twemlow, Major George, Nizam's Army, Aurungabad.

Vansittart, H. Esq. Civil service, Lahore.
Vetch, Capt. Hamilton, Asst. to Commissioner of Assam, Debroghur.
Vincent, W. Esq. Indigo Planter, Cawnpore.

Waghorn,† Thomas, Esq. (Honorary Member.)
Wallace,* A. Esq. Merchant, Calcutta.
Wallich,† N. Esq. M.D., (Honorary Member.)
Walters,*† Henry, Esq.
Warner,† Edward Lee, Esq.
Watkins, Thos. Esq.
Watson,† Major General Sir James, K.C.B.
Watson,† John, Esq. Indigo planter.
Watson,†* Robert, Esq. Indigo planter.
Watt, Robert, Esq. Indigo planter, Tipperah.
Waugh, Captain A. S. Surveyor General of India, Allahabad.
Wemyss, Capt. W. B. 9th Cavalry, Brigade Major, Meerut.
Wemyss,† Captain James.
Wight,* Robert, Esq. M.D. Madras Medical service, Superintendent Government Cotton plantations, Coimbatore.
Williams, Fleetwood, Esq. Civil service, Budaon.
Willis, Joseph, Esq. Merchant, Calcutta.
Wingrove, E. Esq. Merchant, Calcutta.
Wise, J. P. Esq. Indigo planter, Dacca.
Wodehouse, W. E. Esq. Ceylon Civil service, Columbo.
Woodcock, T. Parry, Esq. Civil service, Allahabad.
Woodcock,† E. E. Esq. Civil service.
Woodcock, Lieutenant S. C. (Horse Artillery,) Meerut.
Wood, George, Esq. Calcutta.
Wray, L. Esq. Penang.
Wyatt, Thomas, Esq. Civil service, Rungpore.
Wylie, Macleod, Esq. Barrister, Supreme Court, Calcutta.

Young, G. L. Esq. Indigo planter, Pubna.
Young, J. H. Esq. Civil service, Calcutta.
Yule, J. W. Esq. Indigo planter, Tirhoot.

Meteorological Register kept at the Surveyor General's Office, Calcutta ; for the Month of December, 1845.

Days of the Month.	Moon's Phases.	Observed at 9 H. 50 M. Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of wet Bulb.	Wind. Direction from Sunrise to 9 h. 50 m.	Observations made at Apparent Noon. Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of wet Bulb.	Wind. Direction from 9 h. 50 m. to Noon.	Observed at 4 P. M. Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of wet Bulb.	Wind. Direction from 2 h. 40 m. to 4 p. m.	Observations made at Sunset. Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of wet Bulb.	Wind. Direction from 4 p. m. to Sunset.	Rain Gauges. Elevation. Feet. 56 Upper.	Rain Gauges. Elevation. Feet. 4 Lower.
		Inches	°	°	°		Inches	°	°	°		Inches	°	°	°		Inches	°	°	°		Inches	Inches
1		30,015	75,8	76,5	68,0	N.	29,986	80,4	80,1	67,0	N.	29,923	83,0	81,0	68,1	N.	29,929	79,0	77,0	66,8	N.	..	..
2		,027	75,0	76,0	65,5	N. W...	,982	80,0	80,0	66,0	N.	,910	83,5	81,2	66,1	N.	,910	79,1	76,0	66,2	N.	..	..
3		,000	76,0	77,0	65,2	N.	,951	80,0	80,8	67,8	N. W....	,853	81,2	79,2	65,6	N. W.	,857	76,0	75,0	67,0	N. W.	..	..
4		29,953	76,0	76,0	69,5	N. W...	,919	80,0	80,5	69,0	N. W. ..	,829	82,1	80,8	66,5	N. W...	,831	78,0	76,5	66,0	N. W.	..	..
5		,934	77,4	78,0	72,0	N.N.W.	,885	81,9	81,7	72,0	N. W. ..	,819	83,5	81,6	69,0	WNW.	,818	80,0	78,0	70,2	WNW.	..	..
6	☽	,947	78,0	77,8	70,5	S. W. ..	,914	78,5	79,0	70,5	W.	,837	76,0	76,0	70,2	W.	,836	74,8	75,0	70,5	W.	0,10	0,18
7S.		,937	74,0	75,0	69,8	N.	,900	76,0	76,9	71,6	N. W....	,849	79,0	78,0	71,0	N. W...	,857	77,0	76,5	71,0	N.	..	..
8		30,006	68,0	68,5	55,0	N. W...	,965	71,0	71,2	55,0	N. W....	,884	73,0	71,5	57,0	N. W...	,885	69,0	68,8	55,9	N. W...	..	..
9		,049	67,0	68,0	57,0	W.	30,002	71,0	71,5	55,8	W.	,928	73,2	71,1	57,5	W.	,929	69,5	68,5	58,0	W.	..	..
10		,041	68,0	68,3	56,8	N.N.W.	,006	72,2	71,5	59,5	N. N. W.	,921	74,6	73,0	63,2	N.N.W.	,933	71,0	70,4	62,0	N.N.W.	..	..
11		,087	68,5	69,5	61,2	N.	,005	73,9	73,5	62,3	N.	,945	75,8	73,7	64,0	N.	,947	70,5	69,5	60,0	N.	..	..
12		,090	68,4	69,0	58,0	N.	,047	72,1	72,0	56,0	N.	,969	73,8	72,0	59,0	N.	,970	69,0	68,3	55,2	N.	..	..
13		,056	67,0	68,0	57,4	E.	,007	71,5	71,9	60,9	N. E.	,934	73,5	71,5	57,0	E.	,943	69,0	68,0	55,4	E.	..	..
14S.	○	,082	69,0	69,0	58,0	N. E. ..	,050	71,2	71,0	59,0	N. E.	,974	73,8	72,5	59,0	N. E. ..	,979	70,0	69,0	57,8	N. E. ..	..	..
15		,137	68,0	69,0	62,0	N. E. ..	,098	74,2	74,0	63,2	N. E....	30,026	74,0	73,0	62,2	N. E. ..	30,039	71,5	71,0	61,0	N. E. ..	..	..
16		,147	64,1	65,5	62,0	N.N.W.	,114	67,5	67,0	62,8	N. N. W.	,038	68,0	68,0	64,0	N.N.W.	,041	67,0	67,0	63,8	N.N.W.	0,10	0,18
17		,071	64,0	65,0	62,0	N.	,024	65,0	65,0	63,1	N.	29,952	65,0	65,2	63,5	N. ...	29,944	64,0	65,0	63,0	N.	0,20	0,45
18		,022	68,0	69,0	66,0	N.N.W.	29,995	72,9	73,0	66,0	N. N. W.	,946	75,5	74,0	64,9	N.N.W.	,965	72,5	71,8	65,0	N.N.W.	..	..
19		,153	69,0	69,8	64,0	N.	30,104	73,5	73,0	65,0	N.	30,043	76,0	74,8	65,9	N.	30,040	73,0	72,0	64,0	N.	..	..
20		,146	70,0	70,0	62,0	N.	,119	73,6	74,0	64,0	N.	,037	77,0	75,5	64,0	N.	,048	73,0	72,5	62,0	N.	..	..
21S.		,142	70,0	70,1	62,0	N.	,096	74,0	74,0	64,8	N.	,016	76,5	74,5	63,0	N.	,025	74,0	73,0	62,5	N.	..	..
22	☾	,152	70,0	71,0	64,0	N.	,122	74,0	74,0	64,5	N. E.	,014	77,0	75,2	64,2	N. E. ..	,032	74,0	73,0	63,0	N.	..	..
23		,156	71,0	72,0	66,0	W.	,105	76,0	75,5	65,5	W.	,045	79,2	77,7	66,0	N. W...	,059	75,5	75,0	63,8	W.	..	..
24		,181	71,5	72,5	64,0	W.	,120	77,5	76,8	65,0	W.	,050	79,0	78,0	63,5	W.	,055	75,5	74,9	64,0	W.	..	..
25		..	..	..	..	N.	..	..	..	..	N. E.	..	..	..	..	N.	..	..	..	..	N.	..	..
26		..	..	..	..	N.	..	..	..	..	N.	..	..	..	..	N. E...	..	..	..	..	E.	..	..
27		,137	72,0	73,8	67,9	N.	,090	78,5	77,5	68,0	N.	,012	78,2	77,8	68,8	N.	,031	75,5	75,0	67,5	N.	..	..
28S	●	,102	77,0	78,0	71,0	N.	,059	79,5	78,5	71,0	N.	29,988	81,0	79,8	70,0	N.	29,992	78,0	77,2	70,0	N.	..	..

[O]bservations during the present month, have been made for the most part with a supply of new and first-rate [instrument]s received into the Observatory, by orders of the Bengal Government, a brief description of the Instruments seems necessary.

[Bar]ometer by Troughton, used prior to the 1st June 1844, Observations reduced to 32° Fah. = 29,493

Moon's Phases.	Observed at 9 H. 50 M. Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of wet Bulb.	Wind. Direction from Sunrise to 9 h. 50 m.	Observations made at Apparent Noon. Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of wet Bulb.	Wind. Direction from 9 h. 50 m. to Noon.	Observed at 4 P. M. Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of wet Bulb.	Wind. Direction from 2 h. 40 m. to 4 p. m.	Observations made at Sunset. Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of wet Bulb.	Wind. Direction from 4 p. m. to Sunset.	Rain Gauges. Elevation. Feet. 56 Upper.	Rain Gauges. Elevation. Feet. 7 Lower.
	Inches	°	°	°		Inches	°	°	°		Inches	°	°	°		Inches	°	°	°		Inches	Inches
	..	..	..	..	W.	..	..	..	..	W.	..	..	..	..	W.	..	..	..	..	W.	..	..
	..	..	..	..	W. N. W.	..	..	..	..	W. N. W.	..	..	..	..	W.	..	..	..	..	WNW.	..	..
	30,171	70,0	72,0	65,2	N. E.	30,129	76,8	77,0	63,8	N. E.	30,047	79,5	78,0	64,0	N. E.	30,050	75,0	73,0	64,0	N. E.	..	..
☽	,108	73,0	73,0	64,0	N. E.	,082	75,4	75,0	65,7	W. N. W.	,010	75,2	75,0	65,0	N. E.	,009	74,0	73,5	62,8	N. E.	..	..
	,119	70,5	71,2	62,2	E.	,074	77,0	76,2	62,8	E. N. E.	,011	77,0	76,0	64,0	E.	,015	72,8	71,0	64,0	E.	..	..
	,162	72,2	73,0	63,8	N. N. E.	,122	77,3	77,2	65,1	N. N. E.	,047	78,2	77,0	66,0	N. N. E.	,060	75,0	73,5	67,0	N.N.N.	..	..
	,210	72,0	72,0	65,0	W. N. W.	,180	75,0	75,8	67,8	W.	,097	79,0	77,5	67,5	W.	,104	76,0	74,8	66,0	N. W.	..	..
	,163	71,5	72,0	66,2	S. E.	,120	77,5	77,5	67,8	E.	,047	80,0	79,0	67,8	E. S E.	,044	77,0	75,0	69,0	S. E.	..	..
	,151	74,5	74,9	67,0	N. W.	,106	78,5	78,0	67,5	N. N. E.	,016	80,8	79,9	67,0	N. N. E.	,029	75,5	76,0	66,0	N. N. E.	..	..
	,149	74,5	75,0	66,0	S. W.	,098	78,8	78,1	68,2	N. E.	,006	80,5	79,5	68,2	S.	,009	77,0	76,0	68,0	S.	..	..
	,134	74,0	74,8	67,0	N. W.	,104	77,8	77,8	69,2	S. W.	,047	80,0	79,0	68,0	S. W.	,039	77,0	76,0	67,4	S. W.	..	..
○	,225	72,1	73,0	64,3	N. W.	,178	77,2	77,0	65,2	N. W.	,097	79,8	78,0	66,8	N. W.	,105	76,0	74,9	66,0	N. W.	..	..
	,170	69,4	69,5	60,0	N. N. W.	,114	74,0	74,0	62,0	N.	,020	78,0	77,0	63,0	N.N.W.	,024	73,5	72,0	61,5	N.N.W.	..	..
	,152	70,2	72,0	63,5	N. W.	,087	76,0	75,5	62,0	N.	,030	79,0	77,5	63,0	N. W.	,044	74,0	72,5	66,0	N. W.	..	..
	,170	71,0	73,4	64,0	N. W.	,121	77,5	77,9	64,0	N. W.	,028	80,8	79,0	65,2	N. W.	,026	77,0	74,0	63,0	N. W.	..	..
	,152	70,0	71,0	64,0	W. N. W.	,092	76,2	76,2	68,0	W. N. W.	,006	80,0	78,0	63,0	WNW.	,012	74,2	72,5	64,8	N.N.W.	..	..
	,072	70,0	71,4	63,5	N. W.	,026	76,8	76,8	61,5	N. W.	29,947	80,0	78,5	63,4	N. W.	29,965	76,0	73,5	64,7	N. W.	..	..
	,110	75,0	75,5	68,0	W. N. W.	,071	80,0	80,0	67,5	W N.W.	30,013	82,2	81,0	67,8	WNW.	30,023	77,5	74,0	64,0	WNW.	..	..
	,122	71,0	72,8	63,8	E.	,060	77,5	78,0	65,0	E. N. E.	29,984	81,0	80,0	64,9	E.	29,996	76,5	74,0	63,0	E.	..	..
☾	,133	73,0	74,5	64,5	E. S. E.	,092	77,5	77,0	59,5	E. S. E.	30,037	79,8	78,0	59,0	E. S. E.	30,060	75,0	73,0	63,0	E. S.E.	..	..
	,160	71,0	72,0	59,0	N.	,114	77,0	76,2	59,2	N.	,040	79,0	77,3	59,8	N.	,041	74,5	72,8	59,8	N.	..	..
	,132	70,0	71,5	64,0	W.	,062	77,0	76,4	65,9	W.	29,989	80,8	79,0	64,5	W.	29,995	76,0	73,8	64,0	W.	..	..
	,123	71,9	73,0	69,0	N. N. W.	,056	78,0	78,3	69,4	N. N. W.	30,002	82,0	80,2	65,5	N.N.W.	30,024	77,0	74,9	62,8	N.N.W.	..	..
	,169	72,0	73,0	70,5	W.	,102	78,0	77,0	70,5	W.	,038	82,2	81,0	71,0	W.	,042	78,0	76,0	70,8	W.	..	..
	,120	76,0	75,0	71,0	W.	,088	78,0	78,0	71,0	N. W.	29,988	81,4	81,0	72,5	W.	,007	78,0	77,0	70,5	W.	..	..
	,072	75,0	75,5	71,0	N. W.	,045	79,4	80,0	72,0	S. W.	,984	78,0	76,5	68,4	W.	,010	74,8	74,9	68,0	W.	..	..
●	,092	74,0	75,0	70,5	E.	,046	79,0	79,8	71,2	S. W.	,969	83,5	82,5	71,5	W.	29,967	80,0	79,0	72,0	WNW.	..	..
	,126	74,0	74,9	71,0	N. N. E.	,096	78,2	77,9	69,0	N. N. E.	30,022	79,0	77,9	67,8	N.N.E.	30,023	75,5	75,0	68,0	N·N.E.	..	..
	,148	73,5	75,0	67,0	N. W.	,101	79,5	79,9	68,4	N. W.	,000	82,8	80,4	65,0	N. W.	,000	79,0	77,8	66,7	N. W.	0.46	0.82
	,115	63,9	64,0	62,9	E. S. E.	,060	70,0	70,5	67,5	E. S. E.	29,972	78,0	75,4	69,0	E. S. E.	29,995	75,0	74,5	69,5	E. S. E.	..	..
	[illegible]	[illegible]	[illegible]	[illegible]	S. W.	[illegible]	72,8	73,0	69,5	S. W.	,976	77,5	76,0	70,4	S. W.	,990	74,0	73,8	68,8	S. W.	..	..

The Observations during the present Month, have been made for the most part with a supply of new and first-rate instruments received into the Observatory, by orders of the Bengal Government, a brief description of the Instruments seems necessary.

Barometer by Troughton, used prior to the 1st June 1844, Observations reduced to 32° Fah. = 29,493

[illegible] 1844 .... Ditto .... = 29,637.

Meteorological Register kept at the Surveyor General's Office, Calcutta; for the Month of February. 1846.

Days of the Month.	Moon's Phases.	Observed at 9 h. 50 m. Barometer reduced to 32° Fahrenheit.	Of the Mercury.	Of the Air.	re. Of wet Bulb.	Wi Direction from Sunrise to 9 h. 50 m.	Observations made at Apparent Noon. Barometer reduced to 32° Fahrenheit.	Of the Mercury.	Of the Air.	Of wet Bulb.	Direction from 9 h. 50 m. to Noon.	Observed at 4 P. M. Barometer reduced to 32° Fahrenheit.	Of the Mercury.	Of the Air.	Of wet Bulb.	Direction from 2 h. 40 m. to 4 p. m.	Observations made at Sunset. Barometer reduced to 32° Fahrenheit.	Of the Mercury.	Of the Air.	Of wet Bulb.	Direction from 4 p. m. to Sunset.	Rain Gauges. tion. Upper.	Feet. 4 Lower.
		ches	°	°			Inches	°	°	°		Inches	°	°	°		Inches	°	°	°		ches	nches
1S.		,125	76,0	76,0	,0	S. W. ..	30,090	79,2	79,5	70,0	E. S. E...	30,001	82,0	81,4	68,5	S. W...	30,000	79,0	77,8	68,0	S. W...	..	..
2		109	75,5	76,9	,0	S. W. ..	,049	79,5	79,0	68,0	S. S. W.	29,971	82,5	81,5	68,0	S. S. W	29,980	79,0	78,0	65,0	S. W...	0,23	0,31
3	☽	119	70,0	70,0	,8	N. W...	,101	65,2	65,5	63,9	S.........	30,010	71,0	71,9	68,0	S.......	30,022	70,0	70,0	66,8	S.......		0,28
4		083	71,9	72,0	,8	W.	,067	72,0	72,0	66,5	N. W.....	29,996	76,4	75,0	67,5	W.	,014	72,0	72,0	65,8	W.		..
5		142	68,2	69,0	,0	N. W...	,097	72,0	74,0	66,6	N. W. ..	30,006	75,5	74,8	66,3	N. W...	,016	73,5	73,0	65,0	N. W.		..
6		,119	71,9	72,6	,0	N. W...	,069	77,0	77,5	68,0	N. N. W.	29,986	80,5	80,0	69,0	N.N.W.	29,987	76,0	75,2	68,0	N.N W.		..
7		,132	73,0	74,5	,2	N.N.W.	,070	79,0	79,2	69,5	N. N. W.	,985	82,0	81,0	67,5	N.N.W.	30,002	77,0	76,0	69,0	N.N.W.		..
8S.		,087	76,0	,0	,0	N. W...	,031	80,0	80,0	69,5	N. W.....	,929	82,0	82,0	70,0	N. W...	29,934	78,5	77,0	70,3	N. W...		..
9		29,986	75,5	,2	,5	W.S.W.	29,935	80,0	79,8	73,1	W. S. W.	,861	84,0	83,0	72,0	W.S.W	,866	79,0	78,0	70,0	W.S.W.		..
10		,984	77,0	,0	,0	N.	,942	82,0	82,0	73,0	S...... ..	,867	84,4	84,0	72,8	S.......	,870	79,8	79,5	71,0	S.		0,52
11	○	30,008	67,8	,7	6,0	N. E. ..	,990	71,8	71,8	67,0	N. E.	,928	73,5	73,0	67,8	N. E. ..	,930	71,0	71,0	68,2	N. E. ..		0,20
12		,004	69,5	,2	6,0	... ...	,978	69,5	70,0	65,5	N.	,921	68,5	69,4	66,5	N. ...	,924	67,5	68,0	65,[illegible]	N.		..
13		,010	70,5	,5	6,2	E. N. E.	,970	75,0	74,1	65,8	E. N. E.	,919	75,0	74,9	67,8	E N. E	,921	73,0	72,[illegible]	68,0	E. N. E		..
14		,058	71,0	,0	7,0	N. N. E.	30,013	79,5	79,0	70,2	W.	,947	80,0	79,0	70,0	N.N.E.	,957	77,0	77,0	69,5	N. N. E.		..
15S.		,096	76,0	,0	,9	W.	,082	78,0	77,5	67,2	N.	30,015	81,0	81,0	68,8	W.	30,014	77,0	76,5	68,0	W.		..
16		,157	73,2	,0	,4	N. W...	,134	76,5	77,0	68,2	N. E. ...	,068	77,5	77,8	67,2	N. W...	,067	75,0	75,0	67,0	N. W...		..
17		,168	74,5	,8	,0	W N W.	,129	79,0	80,0	64,0	N. W. ..	,022	82,1	81,8	63,5	N.	,025	78,0	77,9	65,0	N.		..
18		,110	73,8	,5	,0	N. W...	,072	79,0	80,0	60,3	N. W.....	29,982	82,0	82,0	63,9	N. W...	29,995	75,0	74,0	63,8	N. W...		..
19	☾	,126	75,5	,0	,0	S. E. ..	,068	80,8	81,2	64,2	S. E. ...	,987	83,4	83,0	61,5	S. E. ..	,994	76,8	74,0	63,7	S. E. ..		..
20		,156	75,0	,0	,4	N.N.W.	,110	80,5	81,0	68,0	W. N. W	30,005	84,0	83,5	67,8	WNW.	30,007	78,0	75,0	63,5	WNW.		..
21		,106	77,0	,0	,5	E.	,054	81,5	82,1	68,2	E.	29,956	85,5	84,5	69,8	E.	29,958	79,0	78,0	68,0	E.		..
22S		,072	78,0	,0	,5	S. E. ..	,054	80,1	80,0	69,8	S. E. ...	,948	81,0	80,0	69,2	S. S. E	,940	78,0	77,0	69,0	S. E. ..		..
23		,076	75,0	,0	,8	S. E. ..	,054	80,2	80,0	67,0	S. S. E..	,965	77,5	77,0	66,0	S. W...	,977	74,0	74,0	67,0	S.		..
24		,089	75,8	,5	,0	W.S.W.	,058	80,5	81,8	72,5	S. W.	,960	81,5	81,0	72,4	W.S.W.	,954	77,0	76,8	71,0	S. W...		..
25		..	..		..	..	..	..	..	..	S. E.	..	..	..	..	..	..	..	..	..	....		0,27
26		29,975	76,0	,0	,5	..	29,923	81,5	82,0	73,4	S.........	,784	84,8	84,8	76,0	..	,841	66,8	68,0	64,4	....		0,22
27		,985	76,2	,5	,5	S. W...	,914	82,8	83,0	64,5	W. S. W.	,891	85,5	85,3	70,1	S. W...	,907	79,5	77,0	68,0	S. W...		..
28		[illegible]	78,[illegible]	,0	,5	S. S. W.	,972	84,0	85,0	72,0	S. S. W.	[illegible]	87,5	87,0	75,3	S. S. W.	,897	80,5	79,8	74,0	S. S. W.		..

Observations during the present month, have been made for the most part with a supply of new and first-rate nts received into the Observatory, by orders of the Bengal Government, a brief description of the Instruments seems necessary.

arometer by Troughton, used prior to the 1st June 1844, Observations reduced to 32° Fah. = 29,493

	Moon's Phases.	Observed at 9 h. 50 m.					Observations made at Apparent Noon.					Observed at 4 p. m.					Observations made at Sunset.					Rain Gauges.	
		Barometer reduced to 32° Fahrenheit.	Temperature.			Wind.	Barometer reduced to 32° Fahrenheit.	Temperature.			Wind.	Barometer reduced to 32° Fahrenheit.	Temperature.			Wind.	Barometer reduced to 32° Fahrenheit.	Temperature.			Wind.	Elevation.	
			Of the Mercury.	Of the Air.	Of wet Bulb.	Direction from Sunrise to 9 h. 50 m.		Of the Mercury.	Of the Air.	Of wet Bulb.	Direction from 9 h. 50 m. to Noon.		Of the Mercury.	Of the Air.	Of wet Bulb.	Direction from 2 h. 40 m. to 4 p. m.		Of the Mercury.	Of the Air.	Of wet Bulb.	Direction from 4 p. m. to Sunset.	Feet. 56 Upper.	Feet. 4 Lower.
		Inches	°	°	°		Inches	°	°	°		Inches	°	°	°		Inches	°	°	°		Inches	Inches
1S.		30,006	80,0	81,0	74,0	S. W.....	29,990	87,5	87,7	74,8	S. W....	29,895	90,0	90,0	74,5	S.......	29,905	85,1	84,8	74,0	S.......	..	..
2		,008	83,0	83,5	77,0	W.	,969	87,0	87,5	78,5	S. W....	,887	90,1	90,0	75,0	W.S.W.	,894	85,0	84,0	75,0	S. W...	..	..
3		29,981	84,0	84,5	77,6	N. W. ..	,946	88,0	87,8	78,0	W.	,852	91,5	91,3	76,2	W.	,887	85,8	86,0	75,2	S. W...	..	..
4		,999	83,0	83,1	75,0	N. E. ...	,869	88,0	88,5	72,5	N. E.	,887	91,5	91,2	76,2	N. N. E.	,909	86,8	85,0	77,0	N.N.E.	..	..
5	☽	30,042	82,0	84,0	73,0	N. E.	30,003	88,8	89,2	69,8	N. W....	,915	90,5	90,5	71,0	N. W...	,918	84,8	82,0	68,0	N. W...	..	..
6		,017	81,3	82,8	75,6	W.	29,969	88,0	88,5	75,0	N. E.	,884	90,4	90,2	76,8	E.	,901	83,8	83,0	74,0	E.	..	..
7		29,987	84,0	85,0	75,0	S. W.....	,958	89,5	80,5	75,0	S. W....	,858	92,0	91,0	77,0	S. W...	,879	84,0	83,0	75,0	S.......	..	..
8S.		,961	84,0	84,5	74,5	N. N. W.	,938	89,0	89,5	76,0	S. W....	,850	92,1	91,8	72,2	S. S. W.	,854	88,0	88,0	78,0	S. S. W.	..	..
9		,951	86,0	87,0	75,0	S. W.....	,914	91,0	91,4	77,0	S. W.....	,843	93,0	92,0	73,0	S. W...	,859	86,2	86,0	74,0	S. W...	..	..
0		,962	79,0	79,0	70,0	N. W.....	,932	87,0	87,7	71,0	N. W. ..	,819	92,0	91,8	72,0	S. W...	,815	87,0	86,5	74,0	S. W...	..	..
1		,928	84,5	85,4	75,8	S. W.....	,890	90,0	91,0	77,0	N. E.	,816	95,0	95,2	77,1	N. W...	,813	89,0	88,3	78,0	N. W...	..	..
2		,961	84,0	85,0	76,1	S. W.....	,908	90,0	91,0	79,0	S. W....	,812	95,0	94,0	75,8	S. W...	,808	90,8	90,0	78,0	S. W...	0,09	0,15
3	○	,951	82,5	83,5	75,0	E. N. E.	,918	89,0	89,8	75,0	E.	,840	92,8	91,5	74,2	E. S. E.	,843	88,9	88,0	77,0	N. E. ..	0,74	1,04
4		,966	84,5	86,0	75,0	W.	,929	88,5	89,0	75,0	S. W....	,824	92,0	91,8	74,5	S. W...	,818	87,8	86,8	77,5	S. W...	..	..
5S.		,981	85,0	85,6	74,0	S.........	,940	90,0	91,0	76,0	N. E.	,849	94,8	94,4	72,0	S. E. ..	,843	89,0	87,5	74,9	S.......	..	..
6		,977	80,8	81,3	69,5	W.	,920	84,3	85,1	71,5	S.........	,788	90,0	89,0	70,4	S.......	,764	85,0	84,2	72,0	W.	..	..
7		,928	81,5	81,9	67,0	W.	,878	85,0	85,0	65,0	W.	,786	86,5	86,2	66,0	W.	,807	81,5	80,0	68,0	W.	..	..
8		,925	82,5	82,9	73,0	S. W.....	,884	87,1	86,5	73,5	W.	,785	89,8	89,8	73,5	W.	,771	86,0	85,1	74,5	S. W...	0,67	1,11
9		,839	78,0	77,5	71,9	S. E.	,815	83,0	83,0	73,5	N. E.	,738	88,0	86,0	72,5	E. N. E.	,694	83,0	82,8	74,0	E.	..	..
'0	☾	,847	83,5	83,5	77,0	S.........	,821	88,0	88,0	78,0	S. W....	,708	91,0	90,0	74,0	S. W...	,726	84,5	81,5	71,8	S. E. ..	..	..
'1		,869	84,0	85,0	76,1	S. W.....	,832	88,5	89,8	78,4	S. W....	,733	91,0	90,5	78,0	S. W...	,751	84,5	84,0	74,0	S. W...	..	..
'2S.		,884	85,0	85,5	77,0	S. W.....	,860	88,5	89,4	78,5	S. W....	,776	90,0	89,8	79,5	S. W...	,787	85,5	84,7	74,3	S. W...	..	..
'3		,834	85,4	86,0	79,0	S. W.....	,848	90,0	90,8	78,2	S. W....	,753	94,5	94,0	80,0	S. S. W.	,753	89,0	89,0	78,8	S. W...	..	..
'4		,880	86,8	87,5	80,5	S.........	,847	91,5	92,4	75,5	S. W....	,752	94,9	94,5	71,0	S. W...	,753	89,0	87,8	75,0	S. W...	..	..
'5		,898	86,5	87,0	80,5	S. S. W.	,871	92,2	93,0	74,9	S.........	,763	95,6	95,2	76,0	S.......	,757	89,5	89,0	77,0	S. S. W.	..	..
'6		,889	86,9	87,2	79,3	S.........	,848	92,8	93,8	75,0	S. W....	,740	96,8	96,2	78,0	S. W...	,735	90,0	90,0	79,0	S.......	..	..
'7	●	,825	86,9	88,0	76,2	S. W.....	,782	93,5	95,0	76,0	S. W....	,679	99,0	98,0	75,8	S. W...	,678	91,0	90,4	77,0	S. W...	..	..
'8		,817	87,0	87,5	80,0	S. W.....	,783	92,2	93,0	80,2	S. W....	,697	95,1	94,8	80,5	S. W...	,721	88,0	87,0	79,8	S. W...	..	..
'9S.		,829	87,0	87,9	77,0	S. W.....	,790	90,4	90,3	79,5	S. W....	,718	89,0	88,0	77,0	S. W...	,730	86,0	85,2	77,9	S. W...	..	..
'0		,795	85,8	86,7	77,0	S. W.....	,781	89,5	90,1	78,5	W. S. W.	,694	89,4	89,0	80,0	W.	,708	84,0	84,5	79,0	S. W...	..	..
'1		,801	86,0	87,0	79,1	S. W.....	,778	91,0	91,5	80,5	W. N. W.	,687	93,5	92,9	82,0	S. W...	,690	88,0	87,5	81,1	S. W...	..	..

The Observations during the present Month, have been made for the most part with a supply of new and first-rate ...ruments received into the Observatory, by orders of the Bengal Government, a brief description of the Instruments seems necessary.

Barometer by Troughton, used prior to the 1st June 1844, Observations reduced to 32° Fah. = 29,493

Meteorological Register kept at the Surveyor General's Office, Calcutta; for the Month of September, 1846.

Days of the Month.	Moon's Phases.	Observed at 9 H. 50 M. Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of wet Bulb.	Wind. Direction from Sunrise to 9 h. 50 m.	Observations made at Apparent Noon. Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of wet Bulb.	Wind. Direction from 9 h. 50 m. to Noon.	Observed at 4 P. M. Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of wet Bulb.	Wind. Direction from 2 h. 40 m. to 4 p. m.	Observations made at Sunset. Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of wet Bulb.	Wind. Direction from 4 p. m. to Sunset.	Rain Gauges. Elevation. Feet. 56 Upper.	Rain Gauges. Elevation. Feet. 4 Lower.
		Inches	°	°	°		Inches	°	°	°		Inches	°	°	°		Inches	°	°	°		Inches	Inches
1		29,584	86,8	87,0	81,0	S. E. ..	29,556	90,0	90,5	82,7	N. N. E..	29,474	88,0	87,0	82,0	S. E. ..	29,504	83,0	82,8	79,8	S. E. ..	0,10	0,16
2		,595	81,0	81,9	79,0	S. E. ..	,572	81,1	82,0	79,4	N. N. E..	,501	85,0	85,0	81,0	N. N. E.	,511	82,5	83,2	81,0	N. N. E.	0,13	0,20
3		,508	82,8	82,9	80,5	N. W...	,590	86,4	86,3	81,6	N. W....	,488	87,0	87,2	81,5	N. W...	,507	84,5	85,0	81,0	N. W...	..	..
4		,633	87,0	87,0	81,1	N. E. ..	,602	90,7	90,8	82,4	E........	,517	91,5	90,5	82,6	E....	,541	86,0	86,0	80,0	E.	..	..
5	○	,621	87,0	88,0	81,5	S. E. ..	,595	88,5	88,4	81,8	E........	,531	86,2	86,0	81,5	E..	,537	85,0	84,7	80,8	E.	0,07	0,14
6S.		,616	88,2	87,0	81,5	S. E. ..	,594	85,2	85,0	81,9	S. E.	,520	84,4	85,4	81,6	S. E. ..	,532	83,9	84,0	80,5	S. E. ..	0,05	0,11
7		,600	84,5	84,1	81,2	E.	,566	86,5	85,[illegible]	82,2	S. E.	,500	87,0	86,0	80,2	E.	,520	84,0	85,0	81,0	E.	0,08	0,15
8		,620	86,5	86,8	82,0	E.	,606	86,0	84,0	81,0	S. E.	,569	82,5	83,5	80,2	E.	,570	83,0	84,0	81,4	E.	0,38	0,43
9		,717	85,0	82,0	79,5	N. E. ..	,698	86,0	86,0	85,8	E.	,527	87,4	87,2	80,5	E..	,654	85,0	85,7	80,1	E.	0,05	0,10
10		,759	87,2	87,7	81,5	E.	,724	90,1	90,2	83,4	E.	..	..	..	..	E.	,674	84,0	83,6	80,8	E. ..	0,32	0,39
11		,746	87,5	88,0	81,5	E.	,703	89,0	87,8	81,4	N. E. ...	,600	85,6	85,5	80,1	E......	,607	84,4	85,0	80,5	E.	..	..
12	☽	,697	86,8	87,3	82,0	N. E. ..	,645	89,4	89,0	81,0	N. E.	,541	91,2	90,4	82,0	E.	,564	86,8	86,0	82,2	S. E. ..	..	..
13S.		,638	89,0	89,0	82,0	N. E. ..	,618	91,0	90,3	81,0	N. E.	,531	86,0	84,9	81,1	S. E. ..	,565	84,0	84,9	81,0	S. E. ..	0,13	0,20
14		,673	85,4	86,0	79,8	E.	,656	88,0	87,0	79,8	E.	,563	89,0	88,8	81,3	E.	,600	79,2	79,8	78,0	E.	1,11	1,19
15		,644	81,5	81,0	79,0	E.	,623	83,0	83,0	79,5	S. E.	,529	85,0	83,7	79,3	E.	,560	81,0	81,0	78,8	E.	1,94	2,01
16		,706	77,0	78,0	77,0	E.	,676	80,5	82,0	79,5	S. E.	,607	81,5	82,5	79,8	E.	,627	80,0	80,6	79,4	E.	0,75	0,83
17		,761	86,8	86,5	82,0	E. S. E	,731	86,0	85,0	81,0	E. S. E...	,682	82,0	83,0	79,5	E. S. E.	,692	82,0	82,3	79,6	E. S. E.	0,04	0,08
18		,799	86,8	86,4	81,0	S. E. ..	,767	90,0	88,0	82,0	S. E.	,661	88,0	84,0	80,0	S. E. ..	,680	83,8	84,0	80,0	S. E...	...	..
19		,712	87,5	87,5	81,3	S. E. ..	,684	90,0	89,7	81,0	S. E.	,595	92,0	90,5	82,0	S. E. ..	,616	88,0	87,0	82,4	S. E...	..	..
20S.	●	,680	90,0	90,0	82,8	N. E. ..	,655	92,0	91,5	82,0	N.	,571	89,5	89,5	82,0	N.	,589	84,0	83,0	81,0	S. E...	0,64	0,71
21		,610	86,5	86,8	80,0	S. E. ..	,582	78,0	79,3	77,5	N. E.	,488	81,0	80,0	78,4	N. E. ..	,475	80,0	81,0	78,3	N. E. ..	1,92	1,98
22		,645	81,0	81,0	78,4	E.	,640	84,5	83,0	79,4	N. E.	,592	81,2	82,5	79,8	E.	,594	82,0	82,8	80,0	E.	0,74	0,76
23		,732	84,0	83,6	80,2	E. N. E.	,714	84,8	84,5	80,8	E........	,661	80,5	82,0	80,0	E. N. E.	,675	81,0	82,0	80,0	E. N. E.	0,46	0,53
24		,823	86,6	87,5	82,8	E. N. E.	,794	86,7	87,0	81,9	E........	,734	84,8	85,0	80,8	S. E. ..	..	..	..	..		..	..
25	•	..	..	..	..		..	..	..	..		..	..	..	..		..	..	..	..		..	..
26		..	..	..	..		..	..	..	..		..	..	..	..		..	..	..	..		..	..
27S.		..	..	..	..		..	..	..	..		..	..	..	..		..	..	..	..		..	..

Observations during the present month, have been made for the most part with a supply of new and first-rate ints received into the Observatory, by orders of the Bengal Government, a brief description of the Instruments seems necessary.

' 1844 Observations reduced to 32° Fah. = 29,493

Meteorological Register kept at the Surveyor General's Office, Calcutta; for the Month of October, 1846.

	Moon's Phases.	Observed at 9 H. 50 M. Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of wet Bulb.	Wind. Direction from Sunrise to 9 h. 50 m.	Observations made at Apparent Noon. Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of wet Bulb.	Wind. Direction from 9 h. 50 m. to Noon.	Observed at 4 P. M. Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of wet Bulb.	Wind. Direction from 2 h. 40 m. to 4 p. m.	Observations made at Sunset. Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of wet Bulb.	Wind. Direction from 4 p. m. to Sunset.	Rain Gauges. Elevation. Feet. 56 Upper.	Rain Gauges. Elevation. Feet. 4 Lower.
		Inc 29,	°		°		Inches 29,..	°	°	°		Inches 29,..	°	°	°		Inches	°	°			nches	Inches
			..		..	....	..	..	..	..	....	..	..	..	..		..	..	..			..	..
			..		..	....	..	..	..	..	....	..		..	..		..	..	..			..	..
S.			..		..	....	..	..	..	..	....	..		..	..		..	..	..			..	..
	○	..	..	..	..	....	..	..	..	..	....	..		..	..		..	..	..	..		..	..
		,924	87,0	87,4	79,5	....	29,87[illegible]	90,0	90,8	81,7	....	29,80[illegible]		88,0	81,8		29,806	84,6	84,6	78,4	.	..	..
		,877	87,0	87,3	81,0	....	,82[illegible]	91,0	89,3	81,0	....	,74[illegible]		85,0	79,5		,744	82,9	83,5	78,8	.	..	..
		,854	88,0	8[illegible],0	81,0	....	,80[illegible]	90,0	90,5	81,0	....	,730		83,2	79,5		,730	81,7	81,9	78,9	.	0,67	0,81
		,891	86,0	8[illegible],3	79,5	....	,86[illegible]	89,2	88,0	81,4	....	,76[illegible]		87,4	[illegible]0		,779	84,5	84,5	81,0	.	..	..
		,886	86,5	8[illegible],0	80,0	....	,84[illegible]	89,5	88,[illegible]	[illegible]1,0	....	,754		88,5	[illegible]8		,753	87,0	87,0	80,0	.	..	..
S.		,839	87,0	8[illegible],2	81,0	....	,80[illegible]	91,0	89,5	79,5	....	,73[illegible]		87,0	[illegible]5		,742	86,5	86,0	78,0	.	0,14	0,17
	☽	,841	78,8	7[illegible],0	77,0	....	,82[illegible]	78,0	78,0	75,9	....	,759		77,0	[illegible]0	...	,765	74,5	75,8	74,2	.	2,68	2,74
		,836	75,2	7[illegible],1	75,0	....	,76[illegible]	75,0	75,8	74,8	....	,705		77,2	[illegible]6	...	,737	76,0	77,0	75,8	.	1,68	1,74
		,828	78,0	7[illegible],5	78,0	....	,77[illegible]	81,7	80,6	77,4	....	,708		81,0	[illegible]4	...	,739	79,5	79,5	77,5	.	1,18	1,32
		,823	80,2	8[illegible],9	79,0	....	,77	78,6	78,0	76,5	....	,719		79,0	[illegible]0	...	,733	78,5	79,0	77,7	.	0,48	0,61
		,836	84,5	8[illegible],0	80,0	S. S. W	,79[illegible]	80,5	80,5	77,4	S. W. ..	,749		84,0	[illegible]0	...	,765	82,0	82,8	79,0	S. ..	..	..
		,908	84,0	8[illegible],0	80,0	S. S. W.	,859	87,0	86,2	80,2	S.	,80[illegible]		87,0	[illegible]2	W	,818	85,0	85,0	80,0	Calm, ..	..	..
S.		,891	86,0	8[illegible],7	81,0	S. W. ...	,84[illegible]	87,5	88,0	81,0	S. W...	,767		88,5	[illegible]0	W	,775	86,0	85,5	79,2	W.S.W	..	..
		,887	86,2	8[illegible],8	81,0	W.	,83[illegible]	90,0	90,0	82,0	S. W...	,760		89,2	[illegible]	...	,769	87,0	87,0	80,2	S. W.	..	..
	●	,879	86,0	8[illegible],0	81,0	S.	,79[illegible]	89,5	89,0	79,0	S. W...	,75[illegible]		88,5	[illegible]5	....	,760	86,8	86,4	80,0	S. ..	..	..
		,846	86,0	8[illegible],0	81,0	S. E.....	,79[illegible]	89,5	89,5	81,1	S. E. ..	,727		87,8	[illegible]5	E..	,742	82,0	80,0	75,5	N. W.	1,84	1,93
		,841	74,5	7[illegible],0	73,5	E.......	,77[illegible]	77,0	76,8	74,0	E.	,711		78,0	[illegible]0	. . .	,722	78,0	78,0	75,2	E. ..	0,30	0,34
		,818	75,1	7[illegible],0	74,8	N.	,76[illegible]	76,5	77,2	75,8	N. E. ..	,716		80,4	[illegible]3	E.	,718	79,0	79,0	77,0	N. E.	0,29	0,39
		,797	76,9	7[illegible],5	76,0	N. E. ...	,76[illegible]	76,5	77,5	76,5	N. E. ..	,72[illegible]		78,0	[illegible]5	E.	,722	78,0	78,0	76,8	N. E.	0,30	0,40
S.		,773	82,5	8[illegible],5	78,0	N. E. ...	,74[illegible]	83,0	82,5	78,2	E.	,698		78,8	[illegible]0		,710	77,0	78,0	75,6	N. E.	0,10	0,18
		,801	82,0	8[illegible],9	77,0	N. E. ...	,769	85,2	84,3	77,4	N.	,69[illegible]		84,5	[illegible]0		,710	81,9	82,0	76,8	N. ..		
	☾	,815	83,0	8[illegible],0	76,5	N.	,77[illegible]	86,0	86,0	74,9	N.	,716		84,8	[illegible]0		,732	82,0	82,0	74,0	N. W.	..	..
		,809	82,6	8[illegible] 5	76,0	N.	,76[illegible]	85,2	85,5	77,5	N.	,729		83,8	[illegible]2		,729	82,0	82,0	77,0	N. W	..	..
		,799	83,5	8[illegible] 5	78,3	N. E. ...	,76[illegible]	86,5	87,0	79,8	N. W...	,720		84,3	[illegible]0		,730	83,0	83,8	79,0	N. ..	..	..
		,843	85,5	[illegible]5	80,2	E.	,81[illegible]	88,5	87,8	80,0	E......	,753		86,6	[illegible]0		,768	85,5	84,9	79,5	S. E.	0,08	0,13
		,913	85,0	[illegible]8	80,0	S.	,86	89,0	89,2	80,5	W.	,81[illegible]		89,0	[illegible]8		,828	85,8	84,6	78,5	S. E.		

The Observations during the present Month, have been made for the most part with a supply of new and first-rate Instruments received into the Observatory, by orders of the Bengal Government, a brief description of the Instruments

Meteorological Register kept at the Surveyor General's Office, Calcutta; for the Month of July, 1846.

July. Days of the Month.	Moon's Phases.	Observed at 9 H. 50 M. Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of wet Bulb.	Wind. Direction from Sunrise to 9 h. 50 m.	Observations made at Apparent Noon. Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of wet Bulb.	Wind. Direction from 9 h. 50 m. to Noon.
		Inches	°	°	°		Inches	°	°	°	
1	☾	29,489	84,0	85,0	80,0	S.	29,475	87,5	87,8	81,5	S. .. ....
2		,608	81,0	81,5	78,5	S. W.....	,606	85,1	83,2	80,0	S. W. ....
3		,716	83,0	88 0	79,8	S. W.....	,692	89,5	90,5	80,2	S. W.....
4		,722	86,5	87,7	82,5	S. W.....	,688	90,8	91,0	82,0	W. ......
5S.		,693	74,0	80,0	78,0	S..........	,679	79,5	80,5	78,0	W. N. W.
6		,667	76,4	78,0	76,8	S. W.....	,657	77,5	79,0	78,0	S. W.....
7		,672	87,0	87,0	81,5	S. W.....	,658	88,4	88,7	82,9	S. W.....
8	○	,698	87,5	87,6	83,0	N. E.....	,671	90,5	90,4	84,8	N. E.....
9		,729	84,0	85,5	82,0	S. E.	,709	86,8	87,2	83,0	S. E. ....
10		,792	82,8	84,0	81,0	S. S. W...	,779	87,0	87,5	81,0	S. S. W...
11		,776	87,5	87,0	82,0	S..........	,773	89,0	88,8	82,4	S. .. ....
12S.		,738	89 0	89,4	82,5	S..........	,719	90,5	90,2	81,5	S. .. ....
13		,690	89,8	89,2	83,0	S..........	,675	91,8	92,0	83,5	S.........
14		,696	88,0	88,0	82,4	S. E.	,687	89,8	90,0	83,0	S. .. ....
15	☽	,700	91,5	91,0	82,6	S. E.	,670	90,3	89,5	82,5	S. E. ....
16		,640	90,0	89,0	82,6	S. E......	,635	84,5	84,0	80,1	S. E. ...
17		,516	89,0	88,0	82,0	S. E... ..	,522	88,0	86,8	82,0	S. E. ....
18		,576	90,0	90,0	82,5	S. E......	,564	92,5	90,5	82,5	S. ... .
19S.		,643	89,2	89,5	82,7	S. E......	,633	89,0	87,0	82,4	S. E. ....
20		,620	88,5	88,5	81,4	S. E......	,601	88,2	89,0	82,0	S. E. ....
21		,561	89,5	89,0	82,4	S. E......	,531	87,0	85,0	82,0	S. E. ....
22	●	,519	87,0	85,5	82,0	N. E.	,493	89,0	90,0	83,0	S. E. ....
23		,525	87,0	87,5	81,0	S. E......	,492	89,5	89,0	83,8	S. E. ....
24		,510	86,6	86,4	81,5	N. E	,496	85,7	85,8	81,0	N. E. ....
25		,454	85,5	86,6	82,0	S E.	,429	89,4	89,0	82,5	N. E. ....
26S.		,455	87,0	87,2	82,2	S. S. E...	,434	89,0	89,0	82,9	S. E. ....
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	85,0	[illegible]	S. S. [illegible]

July. Days of the Month.	Observed at 4 P. M. Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of wet Bulb.	Wind. Direction from 2 h. 40 m. to 4 p. m.	Observations made at Sunset. Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of wet Bulb.	Wind. Direction from 4 p. m. to Sunset.	Rain Gauges. Elevation. Feet. 56 Upper.	Rain Gauges. Elevation. Feet. 4 Lower.
	Inches	°	°	°		Inches	°	°	°		Inches	Inches
1	29,448	85,8	86,0	80,2	S. W...	29,472	83,8	84,0	79,5	S.......	0,80	0,95
2	,551	86,5	86,5	81,5	S. W...	,570	84,5	84,5	79,5	S. W...	0,19	0,26
3	,634	90,2	90,0	79,8	S. W...	..	..	..	..	S. W...	..	..
4	,618	91,0	91,0	81,2	W... ..	,641	86,0	86,0	79,0	S. W...	0,22	0,30
5S.	,643	97,5	80,0	77,0	S. W...	,631	78,5	79,0	76,0	W. N W.	6,78	7,00
6	,586	82,0	83,5	82,0	S. W...	,601	82,5	83,5	82,0	S. W...	0,13	0,20
7	,578	87,5	87,8	83,0	S. W...	,594	85,0	85,9	82,0	N. W..	0,14	0,22
8	,628	84,5	84,0	79,0	W... ..	,639	84,5	85,0	82,0	N. E. ..	0,23	0,30
9	,665	88,5	88,8	82,8	S. E....	,697	85,0	85,8	81,8	S. E. ..	3,29	3,59
10	,690	89 8	89,0	82,0	S. S. W.	,724	84,8	85,5	79,8	S. S. W.	..	..
11	,690	89,0	88,4	78,5	S.......	,693	84,9	85,0	79,5	S.	..	..
12S.	,637	91,5	91,4	82,6	S.......	,629	87,0	87,5	81,0	S. ....,	..	..
13	,593	89,0	88,8	82,0	S.......	,621	86,0	87,0	81,5	S.......	0,05	0,08
14	,606	90,5	90,0	82,0	S.......	,629	87,0	87,0	82,0	S... ...	..	..
15	,601	86,0	86,0	81,9	S. E. ..	,622	83,5	84,0	80,9	S. E. ..	1,43	1,52
16	,541	87,8	87,0	81,5	S. E....	,519	83,6	83,9	81,0	S. E....	..	..
17	,459	84,0	83,9	82,0	S. E. ..	,470	84,9	85,0	81,0	S. E....	0,28	0,34
18	,509	87,0	83,9	78,7	S.......	,526	85,0	85,0	81,0	S. E. ..	0,25	0,31
19S.	,563	90,0	89,7	82,1	S. E....	,581	86,0	85,8	81,8	S. E. ..	0,16	0,20
20	..	..	..	..	S. E....	,533	85,5	85,5	81,0	S. E...,	0,10	0,15
21	,440	90,0	89,5	82,8	S. E....	,469	83,5	84,0	80,0	S. E.	0,29	0,33
22	,417	89,5	89,0	82,0	S. E. ..	,434	87,5	87,5	80,8	E. N	0,17	0,22
23	,455	87,0	87,5	81,0	E. N. E.	,451	83,5	83,9	80,5	N. E ..	0,05	0,07
24	,420	85,5	83,5	81,0	E..	,432	85,0	85,0	81,0	N. E. ..	0,12	0,16
25	,356	86,4	87,2	83,0	E..	,362	83,0	83,4	81,5	S. E. ..	0,74	0,88
26S.	,386	85,5	85,9	81,4	S. E....	,394	84,5	85,0	81,0	S. S. E..	1,27	1,34
	,387	85,0	85,0	81,0	S. S E.	,402	83,0	83,8	81,0	S. E. ..	0,05	0,11
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0,[illegible]9	0,28

...rvations during the present Month, have been made for the most part with a supply of new and first-rate ... received into the Observatory, by orders of the Bengal Government, a brief description of the Instruments ... seems necessary.

June. Days of the Month.	Moon's Phases.	Observed at 9 H. 50 M. Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of wet Bulb.	Wind. Direction from Sunrise to 9 h. 50 m.	Observations made at Apparent Noon. Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of wet Bulb.	Wind. Direction from 9 h. 50 m. to Noon.	Observed at 4 P. M. Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of wet Bulb.	Wind. Direction from 2 h. 40 m. to 4 p. m.	Observations made at Sunset. Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Temperature. Of the Air.	Temperature. Of wet Bulb.	Wind. Direction from 4 p. m. to Sunset.	Rain Gauges. Elevation. Feet. 56 Upper.	Rain Gauges. Elevation. Feet. 4 Lower.
		Inches	°	°	°		Inches	°	°	°		Inches	°	°	°		Inches	°	°	°		Inches	Inches
1	☾	29,678	89,2	89,4	82,8	W.	29,659	95,0	94,6	84,4	S. W...	29,574	92,5	87,0	78,5	S.......	29,624	85,2	85,0	78,5	S. E. ..	0,72	0,82
2		,692	88,0	87,0	79,0	W.	,663	92,0	91,8	82,2	S. W....	,553	93,4	93,0	83,3	S. W...	,581	89,0	89,0	82,8	S. W...	0,42	0,49
3		,686	87,8	87,9	80,5	S. W ..	,658	91,1	92,1	82,9	W.	,585	92,5	92,5	83,5	S W...	,578	88,0	87,5	79,5	S. W...	..	..
4		,661	90,8	91,5	81,6	W.	,621	94,0	94,5	82,0	S. W.	,533	93,0	92,0	79,8	S. W...	,570	83,0	82,0	77,5	N. E. ..	..	..
5		,689	86,1	87,0	79,0	E. N. E.	,672	89,5	88,4	78,2	S. E... ..	,590	91,3	91,0	80,0	S. E. ..	,619	87,0	87,8	79,0	S. E. ..	..	..
6		,726	83,6	84,0	79,0	E. N. E.	,678	88,0	88,0	80,8	E. N. E.	,573	93,0	92,5	80,8	E. N. E.	,612	89,5	89,4	81,0	E.......	0,08	0,13
7S.		,687	90,0	90,0	82,0	S. W. ..	,663	91,0	90,0	80,8	N. W.....	,602	82,0	82,8	77,5	S. W...	,615	86,0	86,0	80,5	S. W...	0,23	0,30
8		,678	91,9	90,9	82,6	N.N.W.	,648	93,0	93,0	82,8	W. N. W.	,590	86,0	85,8	80,3	N.N.W.	,576	84,0	83,2	78,5	N.N.W.	..	..
9	○	,635	92,0	90,4	83,8	E.	,610	92,2	91,8	82,0	N.	,512	95,0	94,0	82,0	N......	,512	88,0	88,0	82,0	E. N. E.	0,47	0,56
10		,538	92,0	91,5	85,0	E.	,610	79,0	80,0	77,8	N. W......	,512	82,0	82,0	79,5	N. N. E.	,521	82,0	82,5	80,0	E.	0,18	0,27
11		,581	92,5	92,0	86,5	E. N. E.	,543	93,0	93,8	85,0	S. E. ...	,525	79,0	80,0	77,0	E	,549	80,5	81,1	79,0	E. N. E.	0,18	0,27
12		,598	91,0	91,0	84,0	S. E. ..	,573	93,0	93,0	84,2	S.	,530	90,0	84,0	80,0	E.	,550	83,0	84,5	81,5	S. E. ..	0,40	0,48
13		,616	88,0	87,4	82,0	N. E. ..	,610	89,5	89,3	82,8	S. W.....	,532	80,0	81,0	79,0	N. E. ..	,528	81,0	81,5	79,2	N. E. ..	0,10	0,17
14S.		,625	88,0	88,1	81,0	N.E....	,595	96,4	89,6	81,5	N.E......	,535	92,0	91,5	82,0	N. E. ..	,546	88,0	87,0	82,0	N.E....	..	..
15		,684	84,5	85,5	81,0	S. W. ..	,664	87,0	85,7	81,3	S. E.	,576	88,2	87,8	81,5	S. S. E.	,605	85,4	86,0	81,0	S. S. E.	..	..
16	☽	,641	84,0	82,0	78,0	S. E. ..	,624	85,8	86,7	81,1	N. W.....	,549	85,1	85,0	80,0	S. E. ..	,582	82,0	82,8	78,8	S. E....	1,36	1,43
17		,590	82,0	82,0	79,0	S. S. E.	,560	83,0	83,0	79,8	S. S. E...	,493	85,0	85,0	80,5	S. S. E.	,522	80,0	80,7	79,0	S. S. E.	1,16	1,73
18		,572	81,8	82,5	79,5	S. E. ..	,551	86,1	85,0	81,4	S.	,506	84,5	84,8	80,8	S.	,544	83,0	84,0	80,0	S.	0,68	0,77
19		,651	79,8	80,5	78,8	S.S. E.	,625	80,8	81,4	79,3	S. E	,569	88,5	86,0	80,4	S.S. E.	,590	83,0	83,0	79,5	S. S. E	0,24	0,32
20		,691	86,0	86,4	83,0	S.S.E ..	,673	84,0	83,0	80,0	S. S. E. ..	,622	88,0	87,6	82,4	S. S. E.	,640	83,0	82,8	79,7	S. S. E.	..	..
21S.		,711	89,2	89,5	82,0	S. S. W.	,631	91,5	90,8	82,4	S. W.	,602	92,5	92,5	82,4	S.......	,619	86,0	86,0	82,0	S. S. W.	..	..
22		,635	89,8	90,0	82,8	S, W...	,600	90,4	90,5	83,5	S. W.....	,481	94,2	93,9	85,0	S. W...	,498	87,5	87,0	82,4	S. W...	2,48	2,66
23	●	,572	89,5	89,5	83,9	S. E. ..	,537	92,0	90,5	82,5	S.S. E ...	,476	85,5	86,0	83,0	S. E. ..	,501	84,0	83,8	80,0	S. S. E.	0,20	0,26
24		,,	,,	,,	,,	S. E. ..	,576	87,5	87,6	82,0	S.E.......	..	..	..	..	S. E....	..	..	..	..	S. E. ..	0,29	0,36
25		,589	87,0	88,5	82,4	S. E. ..	,570	86,0	85,2	81,8	S. E. ...	,489	87,8	87,0	82,4	S. E....	,508	83,9	84,0	80,0	S.......	0,25	0,32
26		,588	89,0	88,2	82,1	S.E	,568	90,0	89,0	82,5	S. E. ...	,487	90,0	90,0	82,9	S. E. ..	,501	86,0	85,5	81,0	S. E. ..	..	..
27		,588	90,8	90,1	83,0	E.......	,565	91,5	92,0	84,0	S. E.	,481	91,5	91,5	83,0	S. E. ..	,501	88,0	88,0	81,2	S. E. ..	..	..
28S		,549	87,0	87,2	81,5	E.......	,516	90,0	90,2	83,1	E........	,440	93,5	93,5	84,0	S. E ..	,460	87,9	88,2	81,5	S. E. ..	..	..
29		,503	88,8	89,0	82,0	S. E....	,493	92,5	93,0	82,0	S. E.	,415	92,5	92,5	81,0	S. E. ..	,434	85,8	86,0	80,8	S. E. ..	0,33	0,38
30		,511	81,0	81,0	79,0	S. E.. ..	,487	80,0	80,5	78,8	S. E......	,414	83,8	83,8	80,0	S. E....	,427	81,0	82,0	79,0	S. E. ..	0,38	0,42
Mean.		29,626	87,6	86,2	81,6		29,603	88,1	88,8	81,1		29,529	88,1	88,1	81,1		29,549	84,5	85,0	79,5		10,15	12 14

The Observations during the present month, have been made for the most part with a supply of new and first-r[ate] instruments received into the Observatory, by orders of the Bengal Government, a brief descrip[tion] ...

Meteorological Register kept at the Surveyor General's Office, Calcutta; for the Month of May, 1846.

May. Days of the Month.	Moon's Phases.	Observed at 9 h. 50 m. Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Of the Air.	Of wet Bulb.	Wind. Direction from Sunrise to 9 h. 50 m.	Observations made at Apparent Noon. Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Of the Air.	Of wet Bulb.	Wind. Direction from 9 h. 50 m. to Noon.	Observed at 4 p. m. Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Of the Air.	Of wet Bulb.	Wind. Direction from 2 h. 40 m. to 4 p. m.	Observations made at Sunset. Barometer reduced to 32° Fahrenheit.	Temperature. Of the Mercury.	Of the Air.	Of wet Bulb.	Wind. Direction from 4 p. m. to Sunset.	Rain Gauges. Elevation. Feet. 56 Upper.	Feet. 4 Lower.
		Inches	°	°	°		Inches	°	°	°		Inches	°	°	°		Inches	°	°	°		Inches	Inches
1		29,767	90,4	91,0	82,0	S.	29,731	93,8	94,5	83,8	S.	29,633	95,0	94,5	83,2	S.	29,631	89,0	89,0	82,0	S.	..	..
2		,715	90,0	90,8	82,0	S.	,683	93,0	93,0	83,0	S.	,572	92,8	92,4	83,0	S.	,593	86,5	[illegible]	81,3	S.	..	..
3S.	☽	,710	90,0	91,0	81,5	S.	,683	93,0	94,5	83,0	S.	,618	94,5	95,0	82,8	S.	,605	88,5	88,2	78,2	S.	..	..
4		,679	90,0	90,9	82,5	S.	,643	93,0	92,8	83,0	S.	,543	93,0	93,0	82,5	S.	,549	88,0	87,8	80,5	S.	..	..
5		,673	89,0	89,5	81,0	S.	,653	91,0	92,0	82,0	S.	,561	93,8	94,0	83,0	S.	,585	88,0	88,0	80,0	S.	..	..
6		,738	89,2	89,5	81,4	S.	,705	92,0	92,5	83,2	S.	..	..	..	..	S.	..	..	..	..	S.	..	..
7		,730	91,8	92,5	82,0	S. S. W.	,687	97,0	96,2	85,5	S. S. W.	,579	97,0	95,5	83,8	S. S. W.	,598	89,2	89,0	82,0	S. S. W.	..	..
8		,736	91,5	92,5	83,5	S.	,704	96,9	97,0	86,2	S. S. E.	,599	102,1	102,0	86,0	S.	,623	93,0	92,0	83,0	S.	..	..
9		,712	93,0	94,0	81,5	S.	,684	98,0	99,0	80,0	S. S. W.	,610	102,0	[illegible]	81,0	S.	,591	92,0	91,0	82,8	S.	..	..
10S.		,754	92,5	93,0	81,6	..	,735	94,2	95,0	83,0	..	,640	94,5	93,8	81,7	..	,642	89,0	88,0	81,5	..	..	..
11	○	,827	89,0	90,0	81,0	S.	,793	93,0	94,0	81,0	S. E.	,713	93,0	92,8	80,5	S.	,746	89,0	88,9	79,5	S.	..	..
12		,827	90,2	90,5	79,4	S.	,792	91,5	92,0	81,0	S.	,741	95,0	95,5	82,5	S. E.	,726	88,4	88,0	80,0	S. E.	..	..
13		,837	91,5	93,0	80,0	S.	,813	94,8	96,0	82,0	S.	,693	95,0	95,0	81,4	S.	,753	89,0	89,0	80,8	S.	..	..
14		,833	89,0	89,5	80,8	S.	,783	92,3	93,2	81,9	S.	,669	94,8	94,0	82,0	S.	,690	89,4	88,7	81,9	S.	..	..
15		,783	90,4	90,4	82,2	S. S. E.	,746	94,0	95,5	82,2	S.	,663	95,5	94,0	81,7	S.	,695	88,5	88,0	80,0	S.	..	..
16		,770	90,2	91,0	81,0	N. N. E.	,739	95,0	95,5	82,0	S.	,720	75,0	75,4	73,0	E.	,743	75,0	75,0	73,0	E.	0,46	0,46
17S.	☾	,819	87,0	87,5	78,4	..	,778	91,0	90,5	75,5	..	,683	94,4	94,2	78,5	..	,670	90,0	89,0	76,8	..	..	..
18		,800	90,2	91,0	80,0	E.	,758	94,0	94,8	81,0	S.	,648	96,5	95,8	80,8	N.	,660	87,5	87,0	78,0	N.	..	..
19		,737	91,5	92,0	81,0	S. E.	,717	95,0	94,5	81,0	S. E.	,631	91,0	93,4	78,8	S. E.	,643	89,0	88,0	77,0	S. E.	..	..
20		,785	91,5	92,0	80,9	S. E.	,746	96,0	96,7	81,8	S.	,653	93,0	94,0	81,5	S.	,715	89,5	89,0	81,0	S.	..	..
21		..	..	..	..	E. N. E.	..	..	..	..	S.	..	..	..	..	S.	..	..	..	..	S.	0,21	0,30
22		,726	80,5	81,4	80,0	W. S. W.	,684	81,5	81,8	79,0	S. E.	,563	77,5	78,0	76,1	S. E.	,549	77,0	78,0	76,0	S. E.	0,25	0,35
23		,694	86,5	86,5	81,0	S. W.	,666	91,0	91,2	83,8	E. N. E.	,562	93,5	93,0	84,5	N. E.	,580	86,5	87,0	82,0	N. E.	..	..
24S.	●	,673	89,0	89,5	81,0	W.	,645	92,0	92,3	81,1	W.	,555	92,0	92,0	78,9	S. W.	,573	87,4	88,0	80,4	S. W.	..	..
25		..	..	..	..	W. N. W.	..	..	..	..	W. N. W.	..	..	..	..	WN. W.	..	..	..	..	W. N W.	..	..
26		,603	85,5	84,6	79,2	N.	,570	91,2	91,8	80,5	W.	,445	93,0	96,5	82,0	W.	,440	91,4	90,8	80,8	W.	..	..
27		,498	90,5	90,0	79,9	S. W.	,491	94,6	95,0	80,0	W. N. W.	,402	99,0	97,0	84,0	S. E.	,452	89,5	89,0	77,0	S. E.	..	..
28		,620	83,0	83,0	96,5	S. W.	,641	89,5	89,5	79,5	S. E.	,564	95,0	95,0	82,0	S.	,577	91,5	[illegible]	[illegible]	S.		

rvations during the present Month, have been made for the most part with a supply of new and first-rate
eceived into the Observatory, by orders of the Bengal Government, a brief description of the Instruments

Days of the Month.	Moon's Phases.	Observed at 9 H. 50 M.					Observations made at Apparent Noon.					Observed at 4 P. M.					Observations made at Sunset.					Rain Gauges.	
		Barometer reduced to 32° Fahrenheit.	Temperature.			Wind.	Barometer reduced to 32° Fahrenheit.	Temperature.			Wind.	Barometer reduced to 32° Fahrenheit.	Temperature.			Wind.	Barometer reduced to 32° Fahrenheit.	Temperature.			Wind.	Elevation.	
			Of the Mercury.	Of the Air.	Of wet Bulb.	Direction from Sunrise to 9 h. 50 m.		Of the Mercury.	Of the Air.	Of wet Bulb.	Direction from 9 h. 50 m. to Noon.		Of the Mercury.	Of the Air.	Of wet Bulb.	Direction from 2 h. 40 m. to 4 p. m.		Of the Mercury.	Of the Air.	Of wet Bulb.	Direction from 4 p. m. to Sunset.	Feet. 56 Upper.	Feet. 4 Lower.
		Inches	°	°	°		Inches	°	°	°		Inches	°	°	°		Inches	°	°	°		Inches	Inches
1		29,760	86,5	87,0	79,6	S. W. ..	29,730	90,0	90,4	82,0	S. E... ..	29,649	87,0	86,0	80,0	S. E. ..	29,653	84,2	84,5	78,5	S. E. ..	..	..
2		,736	87,9	88,8	78,7	S. E. ..	,723	92,0	93,0	80,2	S.	,624	92,5	91,9	78,8	S.......	,644	85,0	85,4	79,0	S. E. ..	..	..
3	☾	,789	88,0	90,0	71,0	E. N. E.	,764	92,5	93,0	69,5	E....	,677	95,0	94,5	70,1	E. S. E.	,683	89,0	87,2	75,6	E.......	..	..
4		,870	89,0	88,8	77,8	S. E. ..	,845	92,1	92,5	73,1	S. E.	,752	95,5	94,0	75,0	S. E. ..	,760	89,4	87,6	75,0	S. E. ..	..	..
5S.		,890	89,0	88,9	77,9	S. E. ..	,866	89,0	88,9	77,9	S. E.	,754	92,5	92,0	78,0	S. E. ..	,774	85,0	85,0	78,0	S. E. ..	..	..
6		,862	88,0	88,2	79,2	S.	,825	91,9	92,5	78,5	S.........	,706	90,8	90,0	78,0	S.......	,727	84,0	84,4	79,0	S.......	..	..
7		,812	88,0	89,0	79,4	S. S. E..	,781	91,5	92,0	80,5	S. S. E...	,680	90,0	89,2	79,5	S. S. E.	,717	85,0	85,1	78,8	S. S. E.	..	..
8		,873	88,0	89,0	80,2	S. S. W.	,836	91,5	92,0	80,4	S.	,740	91,0	90,5	80,0	S. S. W.	,754	85,0	84,9	79,0	S. S. W.	..	0,08
9		,832	84,0	84,4	73,4	S.	,809	87,0	89,5	80,2	S.	,670	94,5	94,5	77,0	S.	,668	88,5	89,0	78,0	S.......	..	..
10		,751	92,0	92,1	76,5	S. E. ..	,718	95,8	96,0	75,0	S. W... ..	,576	98,5	96,5	78,0	S.......	,578	91,0	91,0	79,9	S. W. ..	0,19	0,23
11		..	..	..	..	S. E. ..	..	..	..	..	N. E.	..	..	..	..	E.	..	..	..	..	E.	..	..
12S.	○	,89[illegible]	89,0	89,2	83,0	S. E. ..	,884	92,5	93,0	85,0	S.........	,753	96,7	95,8	81,9	S.......	,767	91,5	91,0	80,0	S.	..	..
13		,813	89,0	90,0	81,0	S.	,779	95,0	96,0	82,5	S.........	,678	93,8	93,3	83,0	S.......	,674	88,4	88,0	80,9	E... ..	..	..
14		,812	89,5	90,2	82,0	S.	,774	96,0	96,5	81,5	N. E.	,681	98,0	96,9	83,0	S.......	,691	89,0	89,0	81,0	S.	..	..
15		,802	89,5	91,0	81,2	E.......	,777	94,5	95,6	82,0	S. E.	,678	96,0	95,0	83,0	E.......	,683	89,0	88,7	81,5	E.......	..	..
16		,812	89,5	90,0	80,5	S. S. W.	,764	95,0	96,0	74,0	W.	,624	97,0	96,4	82,0	S. S. W.	,653	89,0	89,4	80,0	S. S. W.	..	..
17		,775	90,5	91,0	74,0	W.	,719	95,0	96,1	68,5	N. W.....	,609	98,4	97,8	73,0	W.	,618	91,0	91,0	70,0	W.	..	..
18		,770	89,0	89,8	79,5	S. W...	,734	92,0	93,0	82,0	S. W....	,673	91,2	91,0	80,8	S. W...	,673	89,0	88,7	78,0	S. W. ..	..	..
19S.	☽	,763	90,0	91,0	82,0	S. W...	,743	93,0	94,0	82,8	S. W....	,661	94,8	94,0	82,8	S. W...	,643	89,0	88,5	81,0	S. W. ..	..	..
20		,834	89,5	90,0	81,0	S. E. ..	,795	94,0	94,6	82,5	S. E.	,710	94,0	93,8	83,0	S. E. ..	,724	87,0	87,0	81,0	S. E. ..	..	..
21		,790	89,5	91,0	82,5	S. W...	,774	97,0	98,0	82,4	S. W....	,674	92,5	92,0	82,8	S. W...	,681	86,0	86,1	81,7	S.......	0,18	0,26
22		,885	87,0	87,8	78,0	S.......	,876	91,5	92,5	82,0	S. W....	,772	95,5	95,0	81,0	S. W...	,783	90,5	90,0	80,5	S. W. ..	..	..
23		,938	91,0	91,0	78,0	S. S. E.	,917	95,1	95,5	81,9	N. W.....	,818	99,5	98,0	82,0	N. E. ..	..	..	..	..	S. E. ..	..	..
24		,947	92,0	93,0	78,0	S. W...	,912	97,2	98,0	79,8	S. W....	,788	100,0	99,0	75,0	S. W...	,791	94,0	93,5	79,5	S. W. ..	..	..
25	●	,838	91,0	92,0	79,2	S. W...	,853	97,5	98,0	77,5	S. W....	,741	103,0	102,0	71,0	W.	,747	94,0	93,0	72,2	S. W. ..	..	..
26S.		,836	91,5	92,2	80,0	S. W...	,802	98,5	99,0	79,0	S. W....	,689	103,0	101,8	75,0	S. W...	,701	94,0	93,0	81,8	S. W. ..	..	..
27		,824	91,5	92,1	80,9	S.......	,789	98,0	98,0	84,0	S. S. W...	,706	96,2	96,0	79,5	S.	,712	89,5	89,0	81,5	S.......	..	..
28		,822	91,5	92,0	76,2	S. W. ..	,808	91,0	91,6	76,5	S. W.....	,708	99,5	98,0	74,5	S. W. ..	,718	92,0	91,0	77,0	S. W. ..	..	..
29		,834	91,0	92,0	80,3	S.......	,796	95,0	95,0	81,5	S.........	,692	95,2	95,0	81,0	S.......	,686	89,0	89,0	81,0	S.......	..	..
30		,778	91,0	92,0	81,2	S. E. ..	,751	94,0	95,3	82,5	S.	,656	94,5	93,8	82,0	S...	,633	89,0	87,5	81,0	S.......	..	..

The Observations during the present month, have been made for the most part with a supply of new and first-rate instruments received into the Observatory, by orders of the Bengal Government, a brief description of the Instruments seems necessary.

Meteorological Register kept at the Surveyor General's Office, Calcutta; for the Month of November, 1846.

Days of the Month.	Moon's Phases.	Observed at 9 H. 50 M. — Barometer reduced to 32° Fahrenheit.	Temperature. — Of the Mercury.	Temperature. — Of the Air.	Temperature. — Of wet Bulb.	Wind. — Direction from Sunrise to 9 h. 50 m.	Observations made at Apparent Noon. — Barometer reduced to 32° Fahrenheit.	Temperature. — Of the Mercury.	Temperature. — Of the Air.	Temperature. — Of wet Bulb.	Wind. — Direction from 9 h. 50 m. to Noon.	Observed at 4 P. M. — Barometer reduced to 32° Fahrenheit.	Temperature. — Of the Mercury.	Temperature. — Of the Air.	Temperature. — Of wet Bulb.	Wind. — Direction from 2 h. 40 m. to 4 p. m.	Observations made at Sunset. — Barometer reduced to 32° Fahrenheit.	Temperature. — Of the Mercury.	Temperature. — Of the Air.	Temperature. — Of wet Bulb.	Wind. — Direction from 4 p. m. to Sunset.	Rain Gauges. Elevation. Feet. 56 Upper.	Rain Gauges. Elevation. Feet. 4 Lower.
		Inches	°	°	°		Inches	°	°	°		Inches	°	°	°		Inches	°	°	°		Inches	Inches
1 S.		29,940	86,5	87,0	81,0	W.	29,910	89,5	89,0	81,5	S. W....	29,835	89,8	88,2	81,0	W.	29,851	86,0	85,0	79,0	N.	..	..
2		,984	87,0	88,0	81,0	E.	,935	86,5	86,0	79,0	N. W....	,853	85,5	85,0	80,0	E.	,867	84,0	84,5	79,4	N. E. ..	..	..
3	○	,956	84,6	85,0	79,0	N. E. ..	,920	87,5	88,3	80,0	N. W....	,836	88,0	86,8	76,8	N.	,842	85,0	84,0	77,5	Calm, ..	0,68	0,74
4		,908	79,0	79,5	75,6	E.	,870	83,0	83,5	77,3	N. E.	,803	85,5	83,5	73,1	N. E. ..	,814	81,5	79,8	74,0	E.	..	..
5		,942	80,2	81,4	71,2	N.	,897	84,0	84,0	66,2	N. E.	,845	84,0	82,5	65,4	N.	,857	79,8	79,0	67,0	N.	..	..
6		30,037	79,8	80,5	71,0	N. W...	,985	82,5	82,8	67,8	N. W....	,919	83,5	82,0	68,7	N.	,922	79,2	79,0	69,0	N.	..	..
7		29,993	79,0	80,0	71,0	N. W...	,933	82,5	82,8	71,0	N. W....	,860	83,4	82,4	71,0	N. W...	,869	80,0	79,2	71,4	N. W...	..	..
8 S.		,957	80,0	80,2	71,0	N.	,914	82,4	82,6	71,8	N. E. ...	,856	83,0	81,5	70,8	N.	,867	80,0	79,5	70,5	N.	..	..
9		,996	78,1	79,0	72,0	N.	,950	82,0	81,5	71,0	N.	,884	83,0	82,0	71,0	N.	,891	80,0	79,8	70,5	N.	..	..
10		,984	78,0	78,5	72,0	N. W...	,934	82,2	82,0	70,5	N. W....	,867	83,0	82,0	70,4	W.	,873	79,8	78,0	70,0	N.	..	..
11	☽	,965	79,0	79,8	72,0	N. W...	,910	82,0	82,6	70,0	N.	,860	83,0	82,0	69,8	N.	,872	80,0	79,8	69,8	N.	..	..
12		30,017	80,0	81,0	72,0	N. E. ..	,975	82,9	83,0	70,5	N. E.	..	..	..	..	....	,905	80,0	79,6	70,0	N.	..	..
13		,046	79,4	80,0	72,0	N.	,984	82,8	82,9	70,5	N.	,922	83,0	82,0	70,0	N.	,932	79,0	78,2	70,2	N.	..	..
14		,050	79,0	80,4	71,2	N.	30,000	82,8	83,0	71,6	N. E.	,922	83,0	82,0	70,2	N.	,927	80,0	79,5	72,5	N. W...	..	..
15 S.		,027	80,0	80,5	71,0	N.	29,995	83,0	84,0	72,0	N.	,926	81,8	81,5	81,5	N. ...	,937	80,0	79,5	69,0	N.	..	..
16		,014	80,5	80,0	70,0	N. E. ..	,955	83,0	82,0	68,5	E.	,894	80,5	80,5	69,0	N.	,893	78,5	78,2	70,5	N.	..	..
17		,002	80,0	81,0	69,0	N.	,952	81,8	80,5	68,7	N. E.	,898	83,6	82,0	68,8	N. W...	,918	80,0	80,0	69,8	N.	..	..
18		,052	81,0	81,2	70,4	N. E. ..	30,006	84,5	84,7	72,0	N. E	,941	84,0	83,0	71,0	N. E. ..	,953	81,0	80,5	72,4	N. E. ..	..	..
19	●	,081	79,8	80,2	71,0	N.	,034	83,5	83,5	69,8	N. W.....	,952	83,0	81,9	67,8	N.	,979	79,5	79,0	67,4	N.	..	..
20		,032	77,8	78,0	70,0	N.	29,990	80,5	80,9	70,5	N.	,923	79,5	78,4	70,3	N.	,932	79,5	78,4	70,3	N.	..	..
21		,032	78,0	79,0	72,0	N. E. ..	,974	81,6	81,9	70,9	N.	,900	83,0	81,8	70,5	N.	,909	79,5	78,8	68,0	N.	..	..
22 S		,037	79,5	79,6	71,0	N. E. ..	30,007	79,8	78,5	68,4	N.	,945	79,2	78,8	68,0	N.	,950	78,4	78,0	69,0	N.	..	..
23		,034	77,0	78,0	70,0	N.	29,995	80,0	80,0	71,0	N. W.....	,936	79,8	78,5	68,0	N.	,912	78,0	76,5	68,4	N.	..	..
24		,042	75,0	76,0	71,0	N.	,992	80,8	81,3	72,0	N.	,920	82,5	81,0	71,4	N.	,933	79,0	77,5	69,0	N.	..	..
25		,036	74,5	75,0	70,5	N.	39,005	77,5	78,0	70,0	N. E.	,944	80,5	80,0	68,8	N.	..	..	..	..	....	..	..
26	☾	,054	76,8	77,8	69,8	N. E. ..	,006	81,5	82,0	68,0	N.	,940	82,8	81,2	72,0	N. W...	,953	79,5	78,8	70,0	N.	..	..
27		..	..	..	..	....	,029	79,5	79,7	70,0	N.	,975	81,2	80,6	70,0	N. N. W.	..	..	..	..	....	..	..

Observations have been made for the most part with a supply of new and first-rate Instruments received into
tory, by orders of the Bengal Government, a brief description of the Instruments seems necessary.
rometer by Troughton, used prior to the 1st June 1844, Observations reduced to 32° Fah. = 29,493
by Col. Everest, used from 1st June to 31st August 1844, ... Ditto .... = 29,637
= 29,654

Days of the Month.	Moon's Phases.	Observed at 9 h. 50 m.					Observations made at Apparent Noon.					Observed at 4 P. M.					Observations made at Sunset.					Rain Gauges.	
		Barometer reduced to 32° Fahrenheit.	Temperature.			Wind.	Barometer reduced to 32° Fahrenheit.	Temperature.			Wind.	Barometer reduced to 32° Fahrenheit.	Temperature.			Wind.	Barometer reduced to 32° Fahrenheit.	Temperature.			Wind.	Elevation.	
			Of the Mercury.	Of the Air.	Of wet Bulb.	Direction from Sunrise to 9 h. 50 m.		Of the Mercury.	Of the Air.	Of wet Bulb.	Direction from 9 h. 50 m. to Noon.		Of the Mercury.	Of the Air.	Of wet Bulb.	Direction from 2 h. 40 m. to 4 p. m.		Of the Mercury.	Of the Air.	Of wet Bulb.	Direction from 4 p. m. to Sunset.	Feet. 56 Upper.	Feet. 4 Lower.
		Inches	°	°	°		Inches	°	°	°		Inches	°	°	°		Inches	°	°	°		Inches	Inches
1		30,017	72,0	73,5	67,4	N. W. ...	29,968	78,3	77,8	65,3	N. E.	29,906	80,0	78,0	68,2	N.	29,914	77,0	76,0	65,3	N.	..	..
2		,080	75,1	76,0	68,0	N. E. ..	30,035	78,8	78,0	67,4	N.	,955	80,0	78,0	69,2	N.	,959	76,5	75,0	66,0	N.	..	..
3	○	,068	74,5	75,0	67,0	N. E. ..	,013	77,5	77,0	67,5	N.	,962	77,8	76,8	67,6	N. W...	,968	75,4	74,0	67,8	Calm, ..	..	..
4		,046	72,5	74,0	65,0	N.	29,997	78,5	77,6	68,0	N.	,921	78,5	77,0	70,0	N.	,927	76,0	74,5	67,0	N.	..	..
5		,059	73,0	74,0	67,0	N.	30,014	77,0	76,0	65,0	N. W.....	,956	78,0	76,5	62,8	N.	,964	75,0	74,0	62,0	N.	..	..
6S.		,088	72,5	73,0	62,8	N.	,056	77,0	76,0	62,1	N. W.....	30,001	76,8	74,8	60,8	N.	30,005	73,0	72,0	61,1	N. W...	..	..
7		,109	72,0	73,0	62,8	N.	,067	76,4	76,1	62,6	N. E.	29,985	77,5	75,9	62,5	N.	29,992	74,0	72,7	61,1	N.	..	..
8		,085	71,5	72,0	60,2	N. E. ..	,047	76,0	76,1	61,1	N.	,980	77,8	75,6	65,1	N.	,985	74,0	73,0	59,8	N.	..	..
9		,082	71,8	71,5	61,9	N.	,046	74,3	74,2	63,0	N. (sharp),	,956	76,5	74,2	64,0	N.	,968	73,0	72,0	62,0	N.	..	..
10		,111	69,8	70,0	65,0	N.	,067	72,0	72,8	56,8	N. W.....	30,010	75,0	73,0	57,0	N.	30,020	71,0	70,0	56,2	N.	..	..
11	☽	,155	70,0	71,0	61,0	N. W...	,100	74,8	74,0	60,3	N.	,025	76,0	74,5	59,0	N. W...	,025	72,0	70,0	59,0	Calm, ..	..	..
12		,113	68,0	69,0	62,0	N.	,055	73,0	73,1	62,2	N.	29,973	76,0	74,0	62,0	N. W...	29,991	72,0	71,5	62,0	N.	..	..
13S.		,092	71,0	71,5	62,0	N.	,056	74,8	73,8	63,5	N.	,959	76,8	75,0	63,0	N.	,987	72,0	71,4	62,1	N.	..	..
14		,084	70,8	71,9	63,9	N.	,040	75,0	75,0	63,0	N.	,952	78,0	76,0	64,0	N.	,959	74,5	73,5	64,0	N.	..	..
15		,120	71,0	72,0	65,0	N.	,087	76,0	76,0	65,0	N.	,992	78,0	76,0	64,0	N.	,996	74,5	73,5	66,5	N.	..	..
16		,093	70,8	71,2	64,0	N.	,047	75,0	74,8	63,5	N.	,968	78,0	76,2	62,8	N.	,970	74,0	73,0	62,4	N.	..	..
17		,062	70,0	71,0	63,5	N. W...	,007	75,8	75,8	63,2	N.	,926	78,5	77,0	62,0	N.	,920	75,0	73,5	61,0	N.	..	..
18	●	,055	69,2	70,5	60,0	N.	29,982	74,2	75,0	62,0	N.	,912	77,8	76,0	61,0	N. W...	,917	74,0	72,0	62,0	N.	..	..
19		,046	71,0	71,5	63,0	N.	,999	75,5	75,8	64,5	N.	,925	79,2	77,5	65,5	N. W...	,934	75,5	74,0	67,0	N.	..	..
20S.		,017	72,0	72,7	66,4	N.	,988	75,0	74,8	65,5	N.	,927	75,0	75,2	67,8	N. W...	,932	74,0	74,2	66,0	N.	0,08	0,13
21		,047	65,6	66,0	63,0	N.	30,013	65,0	65,0	62,5	N. W.....	,958	64,0	65,0	64,5	N. E. ..	,958	64,0	64,9	64,0	N.	1,30	1,39
22		,002	64,8	65,4	64,1	N. E. ..	29,977	65,0	65,5	64,4	N. E.	,933	65,8	66,5	65,0	N. E. ..	,932	65,5	66,0	65,0	N.	..	..
23		29,986	64,0	65,0	64,0	N.	,954	69,5	69,4	66,5	N. W.....	,890	75,0	73,5	67,0	N.	,906	72,5	71,9	66,8	N. E. ..	..	..
24		30,046	68,0	69,0	66,0	N. W...	30,006	71,4	71,3	66,4	N.	,949	72,4	72,8	66,4	N. E. ..	,947	71,8	71,4	65,0	N. W...	..	..
25	☾	..	..	..	..	....	..	..	..	..	....	..	..	..	..	....	..	..	..	..	....	..	..
26		..	..	..	..	....	..	..	..	..	....	..	..	..	..	....	..	..	..	..	....	..	..
27S.		,058	71,0	71,5	65,0	N.	,028	75,0	74,8	62,8	N.	,946	77,3	75,8	62,5	N.	,962	73,5	72,7	62,0	N.	..	..
28		,115	70,0	70,8	64,0	N.	,077	74,3	74,0	65,4	N.	30,005	76,0	74,9	63,8	N.	30,013	73,0	72,5	63,0	N.	..	..
29		,139	69,0	70,5	64,5	N.	,092	74,0	74,5	64,2	N.	,021	77,0	75,0	63,5	N.	,032	74,0	72,9	66,0	N.	..	..
30		,190	70,0	71,8	64,0	N.	,142	75,0	75,1	65,0	N.	,056	77,4	75,4	64,0	N.	,064	73,8	73,0	63,0	N.	..	..
31		,214	69,8	70,0	63,5	N.	,172	74,0	74,0	65,0	N.	,109	77,0	75,4	63,8	N.	,122	74,0	73,4	63,1	N.	..	..

These Observations have been made for the most part with a supply of new and first-rate Instruments received into the Observatory, by orders of the Bengal Government, a brief description of the Instruments seems necessary.

Barometer by Troughton, used prior to the 1st June 1844, Observations reduced to 32° Fah. = 29,493